

**Summary Minutes of the United States Environmental Protection Agency (U.S. EPA)  
Science Advisory Board (SAB) Committee on Science Integration for Decision Making  
March 29-30, 2011**

Chartered SAB Members: See Roster<sup>1</sup>

Date and Time: March 29-30, 2010

Location: Westin Alexandria, 400 Courthouse Square, Alexandria VA, 22314

Purpose: To discuss a draft report designed to provide recommendations to support and/or strengthen Agency's ability to integrate science to support environmental decisions and identify the committee's next steps in completing the report.

SAB Participants:

Dr. Thomas Burke, Chair	Dr. John P. Giesy
Dr. Gregory Biddinger	Dr. Rogene Henderson
Dr. James Bus	Dr. James Johnson
Dr. Deborah Cory-Slechta	Dr. Wayne Landis (by phone)
Dr. Terry Daniel	Dr. Thomas Theis
Dr. T. Taylor Eighmy	Dr. Lauren Zeise
Dr. Penelope Fenner-Crisp	

SAB Staff Office Participants

Dr. Angela Nugent, Designated Federal Officer (DFO)

Meeting Summary:

The committee discussion at the meeting followed the issues and timing as presented in the agenda.<sup>2</sup>

**March 29, 2011**

Convene Meeting

Dr. Angela Nugent, SAB DFO, convened the teleconference and welcomed the group. She noted that there had been two requests for oral public comment, that three sets of written public comments had been received prior to the meeting (two sets of comments had been posted on the SAB Web site),<sup>3,4</sup> and that five individuals from EPA were to provide oral comments.

## Purpose and Review of the Agenda

Dr. Thomas Burke, the SAB Committee Chair, reviewed the agenda. He thanked members for their individual comments on the draft report<sup>5</sup> circulated to them before the meeting to help focus the agenda. Members had highlighted the following issues for discussion: the structure of the report; definitional issues, such as problem formulation, and the choice of case studies for the report.

Although time had passed since committee members conducted fact-finding interviews in the period October 2009-February 2010 and EPA's Office of Research and Development has undertaken some major changes since then, Dr. Burke noted that the committee had gathered an unusual body of information. In his view, the primary purpose of the meeting was to agree on key findings and focused recommendations on the most fundamental issues relating to science integration. He described the current timing as an opportunity for the committee to:

- Develop and communicate a consistent definition of science integration, whether the term means transdisciplinary integration (including use of social science), use of problem formulation, "vertical integration" from the Administrator-- through ORD -- to programs and regions
- Address leadership issues: who is going to make science integration happen and how. A major finding may relate to EPA's culture of science and the leadership needed to nurture it.
- Provide recommendations to encourage coordination and communication to break through silos and stovepipes.
- Highlight the issue of science capacity and the need for strong scientific staff
- Highlight the importance of connecting ORD science with Agency decision making
- Emphasize the importance of evaluation – was EPA able to draw on the "right science" and integrate all the necessary pieces for decision making
- Highlight the importance of SAB engagement with the whole community of science within EPA, not just ORD
- Highlight the disconnect seen between "Headquarters" and ORD science and regional needs, where the regions often get science needs met in *ad hoc* ways.
- Highlight the importance of developing mechanisms to exchange best practices regarding science integration
- Describe some best practices for science integration, including "getting the right people to table," i.e., stakeholders, regions and programs, and the importance of the use of social and behavioral sciences in determining these practices

The committee agreed to follow the general structure of the agenda and the approach noted.

## Public comment

Mr. Robert Schreiber provided a brief summary of comments submitted to the committee on May 27, 2010.<sup>6</sup> He focused his comments on the lack of science integration at EPA related to the impacts of allowing municipalities to store sewage in aquifers. An SAB member asked whether his concerns had some connection to issues related to hydraulic fracturing and Mr. Schreiber expressed the view that there was a connection.

Dr. Richard Becker of the American Chemistry Council (ACC) highlighted points made in his written comments, which focused on the Integrated Risk Information System (IRIS). He asked for committee consideration of ACC recommendations related to 1) developing a problem formulation process for IRIS; 2) EPA's use of robust risk assessments developed from other sources; 3) integration of new scientific approaches into IRIS assessments; and 4) development of a robust process for incorporating stakeholders' input into charge questions to inform peer review.

#### Comment from U.S. EPA personnel

Dr. Noha Gaber, Executive Director of the Council for Regulatory Environmental Modeling (CREM) in the EPA Office of the Science Advisor provided oral comment by teleconference. She observed that the committee's draft report notes that "there are resource constraints that impede the effective implementation of institutional mechanisms that promote integration." She asked the committee to "please elaborate on what would be the requirements for 'well-developed science policy councils,' such as the CREM, so that they can serve as effective institutional mechanisms that promote integration? What would these 'well-developed science policy councils' look like, what would their role be?" The committee asked her to provide written information about the CREM to supplement her comments and she provided detailed information.<sup>7</sup>

Mr. Michael Morton, Science Advisor for EPA Region 6, provided comment on the draft report and changes in ORD's role supporting regions over the past year. He acknowledged the important role ORD plays in regional decision making. He told the committee that ORD has shown a marked increase in technology transfer to the regions since the committee's fact-finding interviews. Regions have benefited from improved communication and improved involvement in research planning since the implementation of the "Path Forward" memorandum from Dr. Paul Anastas.<sup>8</sup> ORD's interim National Program Directors leading ORD's new integrated research programs are working actively with program offices and regions to develop research plans. Regional representatives are helping to develop research frameworks, build ORD research portfolios early in the development of research action plans. He noted that he was personally involved in two research action plans. ORD has paid for regional travel for these efforts.

In response to questions from committee members about ORD technical support for regional needs, Mr. Mason noted that ORD has been "defending" funding for Regional Applied Research Efforts (RARE) grants and that ORD had provided good collaboration and support in response to the Gulf Oil Spill in the summer of 2010 and on an epidemiology issue in the Corpus Christi area (ORD scientists joined conference calls, provided input on written reports.) In response to another question regarding systematic tracking of regional requests and ORD responses, Mr. Mason noted that he did not know of plans for regional evaluation of ORD research and science support. He also acknowledged that it is often a challenge to make the RARE grant program work. It takes effort and time to find a project that will benefit both an ORD lab and regional program and that there are limited funds (\$200,000/year/region) available. "When the dialogue is there, however, it is not that difficult to fund the right scientist."

For Region 6, the primary issues regarding science integration involve hydraulic fracturing and surface air emissions from wells. There is a need for real-time monitoring for ozone and particulate matter and a need to expand the “Air Now” program to Hazardous Air pollutants.

Dr. Edward Ohanion provided oral comments in his capacity as Chair of EPA’s Risk Assessment Forum.<sup>9</sup> He noted that the Risk Assessment Forum is preparing a draft Agency action plan for advancing human health risk assessment, based on the National Research Council Silver Book (*Science and Decisions*) recommendations. The Forum is composed of scientists from ORD and program offices and reports to Dr. Paul Anastas, who chairs the Agency Science and Technology Policy Council (STPC) and reports to the Administrator. For this effort, the Forum held a risk assessment colloquium in October 2010. He noted that the draft Forum Action Plan will 1) relate existing EPA guidance to *Science and Decisions*; 2) emphasize the importance of planning, scoping, peer review, and stakeholder involvement; 3) address overarching Agency issues such as sustainability, children’s health, and environmental justice; and 4) discuss how new science can be incorporated into EPA human health risk assessment. The Forum is also developed draft action plans related to training and capacity building. The Agency’s STPC is currently reviewing all the draft action plans described by Dr. Ohanion. The action plans can be released publicly after they are approved by the STPC.

After Dr. Ohanion completed his remarks, he responded to several questions from the committee. When asked how the SAB Committee on Science Integration for Decision Making can help ensure implementation of the science integration efforts Dr. Ohanion described that had been the “focus of efforts in past,” he responded that it would be helpful to highlight the need for resources and availability of staff. Members of the Risk Assessment Forum must have time available to work on Forum projects. He also mentioned that the success of Forum guidelines depends on implementation by individual EPA program. EPA managers need to make sure that scientific analyses to support environmental justice, sustainability, and children’s health goals are met. It is helpful to have models and guidance, but implementation depends on leadership, and the role of the STPC is critical. Dr. Ohanion also noted that the Forum had a committee dedicated to ecological issues and that both the Forum health and ecological committees emphasize the importance of problem formulation before an analysis is launched. Such formulation must include the economic and social dimensions of problems. Dr. Anthony Maciorowski noted that the Forum had recently completed a report on ecological assessment and committed to providing the committee with a copy of the report.<sup>10</sup>

Mr. Ken Munis, Deputy Director, Office of Regulatory Policy and Management in the Office of Policy provided some remarks at the DFO’s request about EPA’s Action Development and analytical blueprint process. His office has the following functions. It sets up work groups with members from across EPA to support major action actions, including all regulations and major guidances. His office provides guidance, policies, and training. The analytical blueprint process was established to provide decision makers with the information and data they need throughout the development of an agency action. The Office of Policy has also provided interim guidance on environmental justice concerns in major agency actions.<sup>11</sup> Mr. Munis also promised to make general guidance on EPA’s analytical blueprint process available to the committee.<sup>12</sup> He noted that most Agency work groups discuss an analytical blueprint and try to get early input from senior managers about the kinds of information they need to support their decisions. The

blueprint provides a process and structure for developing a realistic analytical plan within the regulatory development timeframe. The blueprint helps the work group members keep regulatory analyses on track. Generally, a work group focuses on a specific regulatory question and the analytical blueprint reflects that relatively narrow focus. The Committee Chair asked whether Mr. Munis could provide a sample of an analytical blueprint or a schematic of one.

Mr. Munis then responded to questions from committee members.

- He noted that EPA does not have a process in place to evaluate whether a blueprint was successful, although EPA is currently responding to a request from the President in a new Executive Order to determine whether regulations have been effective.
- In response to another question, Mr. Munis noted that the blueprint process is triggered by notification of a planned Agency action and the “tiering request” that helps to determine whether a blueprint is merited. The action development process is mostly initiated by EPA programs and rarely by regions. Committee members asked whether the Policy Office had explored use of the Action Development Process for decisions by EPA regions for their decisions, including risk-related decisions. Mr. Munis responded that the Policy Office has not explored this question, although it does have coordinators and liaisons with different regions, and especially shares information about tiering actions with Agency contacts involved in community-based decision making.
- Mr. Munis noted that the Regulatory Steering Committee holds a bi-weekly meeting and relies on ORD’s Office of Science Policy to “provide science linkage” and linkage to the SPTC. An SAB committee member observed that the analytical blueprint within the Action Development Process provides a formal structure for “incentivizing engagement in science.”
- Mr. Munis noted that analytical blueprints specify economic analyses required by actions and also considers issues of implementation and incentives. The blueprint requirements vary depending on the needs of particular regulation. Economics is the primary behavioral science that is involved.
- EPA is working with interim guidance on incorporating environmental justice in Agency actions. The guidance forces the work group to answer a specific set of questions. The SAB Office Director, Vanessa Vu, noted that EPA has asked the SAB to review the interim environmental justice guidance and to provide advice on environmental justice issues. A committee member noted that step 5 in the interim environmental justice guidance calls for use of social science.
- The Policy Office periodically updates guidance on the Action Development process. It supplements the guidance with a two-day training program that has been successful in “bringing in champions for different issues” such as science, economics, or state perspectives. These “champions” help make an impression on work group members. Brown bag discussions and webinars on particular parts of the process also supplement the guidance.

Ms. Brenda Grokinsky, the Science Policy Advisor and the Office of Research and Development’s Science Liaison for EPA Region 7, provided comments<sup>13</sup> on behalf of the Regions and as a representative of Region 7, in its role as ORD Lead Region and the Regional

Science and Technology program for 2011 and 2012. She noted that Region 7 had worked with ORD to coordinate regional involvement in research planning and in highlighting Regional Science and Technology activities. She thanked the committee for highlighting the importance of Regional Science Liaisons and Superfund Technical Liaisons. She committed to providing the committee with information about ORD's Superfund Technical Support Centers for Groundwater and Engineering and Site Characterization and Monitoring.

In response to questions, Ms. Groskinsky responded that regions generally received the science support they need. SAB committee members reflected that regional interviewees had not reported such general success during the committee's fact-finding interviews. When asked about problem formulation in the regions, Ms. Groskinsky responded that regions may have different issues from one another, but in general, their focus is on implementation of national regulations and policies. In Region 7, priorities are set by top management. Senior managers generally convene the first meetings to formulate problems. When science is needed, Region 7 seeks its information within the region and, if needed, then turns to ORD.

Ms. Groskinsky described how regional science liaisons hold weekly conference calls. They communicate frequently with each other and with ORD. Regional Science Liaisons visit two ORD laboratories each year and make efforts to meet ORD scientists and learn about their work.

The SAB Chair asked Ms. Groskinsky "what would make the Regional Science Liaisons life easier." She committed to consult her Regional Science Liaison colleagues and to respond to the committee.

Dr. Robert Fegley from ORD's Office of Science Policy, described the analytical blueprint process from an ORD perspective. In the Office of Science Policy, he organizes ORD's involvement during the regulatory development process. The development of every rule concludes with a memorandum from every Assistant Administrator indicating concurrence, non-concurrence, or concurrence with comments on the rule being considered. His office develops ORD's memo and considers outstanding science issues. In an ideal case, a program office initiating a rule would inform other parts of the Agency of that action. All offices interested in the rule would identify workgroup members, who would work together to develop an analytical blueprint, where scientific and other issues would be identified. There would be an early guidance meeting, where Dr. Fegley's office would flag issues where ORD workgroup members view the science issues differently from the program office. During options selection for the rule, ORD would point out scientific shortcomings or the strengths of different options, considering, for example, how risk assessment information and other science affect different options. ORD advises the Administrator of the "up sides or down sides" of different options. After the preferred option is selected, the Program Office drafts the preamble and rule. ORD reviews these drafts to see if they agree with the science and to identify any potential issues.

After his remarks, Dr. Fegley responded to questions from committee members.

- He noted that at times ORD is asked to help decide whether the science is sufficiently "ready" to support a regulatory action
- He noted that the analytical blueprint process is a strong process but was "inconsistently applied," when there are legal pressures to expedite an action. At

times, some analytical blueprints are quite good in identifying sciences issues, but because of time and other pressures, EPA does not follow or amend the plans.

- In response to a question about stakeholder involvement, Dr. Fegley commented that generally stakeholders are less interested in science than in policy position where they have pre-determined interests.
- Stakeholder input for problem formulation happens in OAR's National Ambient Air Quality Standards (NAAQS) process, which holds an initial workshop to "kick off" a NAAQS review process. It might be possible to organize a similar process for Tier 1 rules.
- Dr. Fegley noted that it would not be practical to develop an Integrated Science Assessment, similar to the assessments developed for the NAAQS, for all EPA rules because of limited resources. EPA has made efforts to write regulatory preambles so that science and policy are more clearly delineated, but sometimes "you have to extract the science with difficulty."
- Dr. Fegley emphasized that EPA follows this structured process primarily for all rulemakings and its most important guidance, but these constitute only a small percentage of all actions. For decisions in emergencies, the Agency makes decisions "by the seat of the pants."

### Discussion of draft report

Committee members discussed the overall tone and intent of the report, emphasizing that it should be designed to take a high level perspective and build on the prior work of the SAB and National Research Council, which advised EPA to frame science for decision making. They emphasized the need to provide strategic, big-picture advice and not evaluate multiple methods. They also agreed that the objective is to provide "prospective" advice, not retrospective analysis and to highlight best practices, where available.

Members made the following points about areas to emphasize in the report:

- Frame the report in terms of EPA science, not ORD science, and include mention of the Administrator's priorities on page 4
- Importance of problem formulation, driven by regulatory requirements and Agency mission
  - Need to identify "where do you start"
  - Consider framing problems more broadly than the charge to the committee, which was focused on risk, rather than sustainability
  - Suggestion - evaluate evaluating nominal practices that seem "best practices" for science integration, perhaps focusing on the action development process, IRIS, Multi-Criteria Integrated Resource Assessment (MIRA)
  - Discussion should describe attributes of best practices for decisions at different levels and allow for flexibility in applying best practices and fitting them to different needs
  - Discuss role of stakeholder involvement
    - Essential for "buy-in" and to understand the scope of the problem
  - Add to the definition on page 7

- Stakeholder involvement
  - Options consideration
  - Some consideration of data and information, maybe include blueprint process
  - Add that trade-offs should be identified
  - Frame in terms of sustainability
  - Add consideration of the “social context relevant to the decision,” perhaps borrowing from language used by Glenn Suter on ecological risk assessment.
- Dr. Gregory Biddinger committed to provide a schematic for problem formulation
- Discuss problem formulation tools and institutional mechanisms
- This report’s niche is “the practice” of science integration
  - Need to define science integration – group agreed that the focus is “integrated science for decision/policy making”
  - If “integrated science for decision/policy making” is effective, then integrating different sciences would be part of the process.
  - Briefly describe what works and what could be improved
    - One member expressed concern about the committee’s evaluating current processes as “good science integration processes,” without defining what “good” means
  - Describe how the social and behavioral sciences should be involved
  - Problem formulation can help define the sciences that should be integrated
  - Suggestion: include a diagram of science integration
  - Dr. John Giesy committed to providing a diagram of science integration

The committee discussed other suggestions for revising the report

- Move examples to an appendix
- Shorten the report
- Include text boxes to briefly outline science integration practices; use the appendix to more comprehensively lay out key findings from the interviews
- Use examples to illuminate the major findings, themes in the report to illuminate what worked what didn’t
- Case examples suggested to include:
  - A stormwater research example described on page 185 of the compilation of interviews.<sup>14</sup> The research focused on a significant national problem, integrated a variety of sciences (e.g., science, hydrology, economics) to develop a reverse auction technique; and was applied and evaluated.
  - MIRA
  - Action Development Process/ blueprint process
  - Regional science liaisons
  - Superfund programs
  - Regional Applied Research Efforts (RARE) grants
  - National Ambient Air Quality Standards
  - Use of strong local resources in Regions 1, 2, and 9 and ability to reach out and get local resources

- Region 7 Kaizen process
- Health Effects Institute Case study
- Suggestion: use a hypothetical example that may illuminate all the elements of science integration of interest, “without being restricted by the facts”
- Move major findings up front. Make them shorter and then provide supporting materials and logic. Pair findings and recommendations
- An Executive Summary should identify the strongest recommendations about leadership and institutional mechanisms.
- Keep the report short (1-12 pages)

The committee discussed potential key findings. Some initial ideas advanced include:

- Silos that can be overcome by science integration
  - Breaking down silos makes decisions less familiar and makes problem formulation more important
- There is tension between ORD and EPA customers that is a classic supplier/customer problem. The solution must be institutional structural change, linking expected work products to decisions. Need revolutionary and hard hitting recommendations.
- Expand bullets on page 37, build report around them
- EPA’s science integration process is generally as good as it can be

The committee chair asked committee members to divide into groups to revise the report. He asked the following committee members to serve as the leads the following assignments:

Assignment	Lead(s)
Introduction	Dr. Thomas Burke and Deborah Cory-Slechta
Key Definitions	Dr. Thomas Theis
Current practices	Drs. Penny Fenner-Crisp and John Giesy
Examples	Dr. Taylor Eighmy
Key findings and recommendations	Dr. James Bus

He asked the lead committee members to prepare draft revised text for discussion during the March 31, 2011 public meeting.

The meeting recessed for the day at 5:30 p.m.

**March 31, 2010**

Members of the committee held a writing session and provided brief updates on their planned revisions to the draft report.

- Dr. Deborah Cory-Slechta provided draft text for a revised introduction (Attachment A)

- Dr. Thomas Theis provided draft text for the definitions sections (Attachment B)
- Dr. John Giesy provided draft text describing current practices (Attachment C)
- Dr. James Bus provided draft text identifying findings and recommendations (Attachment D)c

Members also discussed

- Adding the charter of the Science and Technology Policy council to the SAB Web page<sup>15</sup>
- Reviewing the SAB report on responding to natural disasters<sup>16</sup>, to make sure the committee’s recommendations are relevant to environmental decisions that have short time frames
- Reviewing the SAB report *Science and Stakeholder Involvement*<sup>17</sup>
- Any central diagram should be simple because there is no “one-size-fits-all” approaches for science integration. It may be appropriate to have different diagrams for different decision contexts (e.g., natural disasters, NAAQS)
- The principal contribution of the report is to develop advice on the “power of problem formulation” and how stronger science integration can “make it more fun, more powerful to be scientists
- Underscoring the message that “people matter; stakeholders matter; EPA scientists matter.” The report should recommend building and sustaining capacity, human development and leadership training.
- Include a finding that EPA science-based decision making process not be overly constrained. Expand discussion in the draft report about stretching the statutory box and not being overly constrained by precedent.
- If possible, discuss the importance of building a culture of trust, so Congress isn’t prescriptive in requiring EPA to use scientific information or methods that may become outdated. Ideally, decisions should involve problem formulation
- Clarifying and distinguishing all the different means of the term “science assessment” used in the draft report (Attachment E)

The Designated Federal Officer adjourned the meeting at 2:00 p.m..

Respectfully Submitted:

*/Signed/*

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Dr. Angela Nugent  
SAB DFO

Certified as True:

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Dr. Thomas Burke  
Chair, SAB Committee on Science  
Integration for Decision Making

## **Attachment A: Draft introductory test (from Dr. Deborah Cory-Slechta)**

In its mandate to protect human health and the environment, the EPA must make regulatory and policy decisions, some of which are in response to unpredictable events, and others of which are evaluated on a more fixed often repeating time frame. Dependent upon the situation or context, the Agency may have very different time frames to make those decisions and differing levels of scientific and other pertinent information. At the request of the EPA Administrator in 2009, the SAB was asked to undertake a study to examine how such integrated decision making occurs within EPA, including the incorporation of scientific information integrated across all appropriate disciplines. Such a study provides the opportunity both to identify the most useful approaches and the extent to which some processes could be enhanced. Such a premise followed on earlier SAB guidance that stated that an integrated science approach to inform decision making was needed to effectively address new and complex environmental problems and make use of increasingly complex science from a wide array of relevant disciplines.

The specific charge to the SAB was as follows:

*The new SAB study will evaluate the extent to which EPA's scientific assessment practices are integrated into environmental decision-making practices as previously recommended by the NRC and the SAB. The study will focus on EPA's application of scientific assessments in environmental decisions .... The SAB will identify barriers to implementing NRC and SAB recommendations and suggest immediate and future actions that EPA could take to develop and institutionalize integrated environmental decision-making. Areas of consideration may include scientific leadership, scientific practices, scientific collaboration across disciplines, and scientific expertise and workforce. The SAB may also make additional recommendations, beyond those previously provided by the NRC and SAB, to improve the integration of EPA's scientific assessments for decision making.*

During the course of the SAB study, changes occurred within the EPA leadership that included the introduction of a "Path Forward" strategy (2010) that described a vision, now undergoing implementation, for a trans-disciplinary systems-oriented approach to sustainable solutions. The changes related to integrated decision making at EPA produced by the new "Path Forward" approach may already begin to address some of the recommendations arrived at by the SAB. The goals of this study, as defined by the SAB were to identify those highly effective approaches in use within the Agency that may further assist in enhancing the ability of the Path Forward to achieve its goals, and in so doing, to identify some other recommendations from which it may further benefit.

In its formulation of an approach to this study and its deliberations, the SAB focused on identification of points and methods of initial problem formulation, the administrative structure for integrated decision making, and the information incorporated into the decision. The inclusion of initial problem formulation as important to the SAB study was Guided by the NRC 2009 report entitled Science and Decision Making that encouraged EPA to: "...focus greater attention on design in the formative stages ...specifically on planning and scoping and problem

formation...” as articulated in previous EPA guidance that involves inclusion of various stakeholders early in the process...”to determine the major factors to be considered, the decision-making context and the timeline and depth needed to ensure that the right questions are being asked...”

Given that integrated decision making occurs throughout the EPA, the SAB study included assessments and data gathering at all levels of Agency operation. From distillation and consideration of these data, the Study identified what it considered to be particularly efficacious approaches for integrated decision making as well as areas where integrated decision making might be further strengthened. These are highlighted in this report and illustrated by corresponding Case Reports.

(Incorporate this point above: ) Although the report focuses on science integration for decision making, it does not, however, assume that science (integrated or not) is the sole input for environmental decision making. Other factors, such as law, politics, policy, and values also play important roles (Bipartisan Policy Center. 2009), both for successful policies and for failures of policies. However, the report does assume that increased use and better integration of science will reduce uncertainties for decision makers, although it recognizes that some level of uncertainty will always be present when environmental protection decisions must be made. Finally, this report focuses on EPA processes promoting or impeding science integration; it does not provide an evaluation of the quality of EPA’s decisions or the quality of EPA science.

The remainder of the report is organized as follows ....

## Attachment B: Definitions (from Dr. Thomas Theis)

### For the Executive Summary--definitions

This report presents the results of a study conducted by the Science Advisory Board (SAB) in response to request from the Administrator to evaluate the extent to which EPA's scientific assessments are integrated to support environmental decision making. At the outset, the Committee undertook the task of defining key concepts that are at the core of the study so that there is a common set of definitions from which to proceed. Two such concepts are central: "science integration", which is the identification, collection, and application of scientific data, models and concepts from multiple scientific disciplines to support decision-making and problem solving, and "integrated decision making", which is the deliberate inclusion of results of different types of scientific assessments in the process of decision making and problem solving. The former is often referred to as cross-disciplinary science—an approach that spans a range of functional pathways from multidisciplinary and team-based, through various degrees of expansive meta-disciplinary engagement, to the generation of one or more inter-disciplines in which new fields of knowledge are generated that provide new perspectives, tools, and methods of analysis for problem solving. The latter is a further extension of integrated science in which, from very initial stages, decision making and problem solving are conceived and viewed in a holistic and complete way so that resultant decisions and solutions, while seeking the efficient reduction of aggregate risk to populations and ecological systems, are also congruent with the principles of the systems-based sustainability paradigm. Together, "science integration" and "integrated decision making" comprise the concept of "integrated transdisciplinary research (ITR)", as expressed in the "Path Forward" memorandum (March 4, 2010) to ORD staff from the Assistant Administrator Paul Anastas.

(This next part may not work for the executive summary—maybe better for section 3 (page 7))

Complete science integration for decision making involves several stages:

- Problem formulation: An activity designed to meet the needs of Agency decision making in which the goals of the assessment/action are identified and fully articulated, stakeholders are identified, assessment endpoints are selected, tradeoffs are identified, the conceptual model is prepared, and an analysis plan is developed.
- Acquisition of the science required. Scanning sources for existing science and acquiring new science (i.e., through research), if needed.
- Assessment of available science. Evaluating the state of existing science on a particular issue as it relates to EPA's mission.
- Integration of available science across different disciplines and sources. Cross-disciplinary and collaboration across sectors to provide the science needed by decision makers.
- Communicating about integrated science with decision-makers and the public. Communicating the major findings of integrated science activities, including its complexities and uncertainties.
- Evaluating the use of integrated science for decision making. *Post*-decision evaluation of the use of science for improved decision making in the future.

(And...the following is a paper (among several by these authors) on the Shepherd's Creek project—an example of "integrated transdisciplinary research" that I propose for one of our "text box" examples)

Hale W. Thurston, Michael A. Taylor, Allison Roy, Matthew Morrison, William D. Shuster, Joshua Templeton, Matthew Clagett, and Heriberto Cabezas (2008), “**Applying a Reverse Auction to Reduce Stormwater Runoff**”, *AMBIO: A Journal of the Human Environment* 37(4):326-327  
Available at: [http://www.bioone.org/doi/abs/10.1579/0044-7447\(2008\)37%5B326%3AAARATR%5D2.0.CO%3B2](http://www.bioone.org/doi/abs/10.1579/0044-7447(2008)37%5B326%3AAARATR%5D2.0.CO%3B2)

### Attachment C: Description of current practices (from Dr. John Giesy)

Science is only one element of decision making at EPA. Science can enter the decision making process at many levels and is utilized in many ways that vary among issues and locations within EPA. Currently the use of science is somewhat a hoc throughout the various programs and functions of EPA. While there are guidelines for rulemaking and decision-making that are applied within the agency, these various types of guidance are applied unevenly across the agency. Some of these systems are quite well defined, codified and applied, while others are not. Recent changes in processes and procedures being implemented under the “Path Forward” vision are appropriate and if fully implemented will assist in making the use of science or the perception of the use of science in decision making less a hoc. In this vision, the agency, through self evaluation and through response to suggestions from the SAB has embarked on a process of developing an more flexible system of holistic thinking. The vision is to involve a wider spectrum of disciplines in the decision-making process, including science, both the natural sciences and social sciences. This process of Integrative, Trans-disciplinary Research is being implemented to guide problem solving research within the Office of Research and Development (ORD). This systems approach to problem solving has the advantage of gathering multiple perspectives so that the best solution can be developed without causing other problems in the process. The approach recognizes that all of the media that are currently separated into different offices and programs and legislation are indeed linked. The panel finds this approach has many merits and should be expanded beyond ORD to other levels of organization within EPA. This is an attempt to breakdown the “silo effect” from which EPA has long suffered. This model can be expanded to reach beyond the disciplines of natural science and include the social sciences and specific areas of emphasis, such as sustainability and environmental justice. The panel suggests that a flexible framework for decision making be developed that can be applied across the agency to assure effective communication and inclusion of relevant science in all decision-making processes. A decision tree approach with appropriate linkages and feed-back loops would be most effective. The panel is not suggesting a proscriptive approach, but rather an adaptive approach to decision making.

It is not as important what the method is, but rather that there is a framework to be applied in the decision-making process. There are many of these frameworks available and some are currently applied within the agency. Several that are currently used within EPA that seem to affect the most efficient and appropriate uses of science include the Action Development Process (ADP) for developing Analytic Blueprints. If applied rigorously, this process can insure that the most appropriate scientific information and or uncertainties relative to scientific knowledge are brought to bear on the decision-making process at appropriate points.

Another process is the Multi-criteria Integrated Resource Assessment (MIRA) program. Region 3 has integrated the use of (MIRA) with logic models to integrate science for decision making. MIRA is an approach that provides a transparent means for stakeholders (including decision makers) to learn the relationship between the data and the decision options and provide a rationale for the final decision. MIRA organizes data, engages expert and non-expert stakeholders in different but integrated roles, and incorporates stakeholder values by facilitating discussion within context of the decision. Region 3 uses MIRA to facilitate discussions among

**Comment [A1]:** Give a listing of possible frameworks. US ACOE has some that can be cited here. See the BOSC report I sent to Angela for a whitepaper on possible frameworks and their relative merits.

**Comment [A2]:** Give a listing of some of the other frameworks ADP and US EPA guidance for ecological risk assessments

**Comment [A3]:** Add citation to DAP process.

**Comment [A4]:** My blue sections are taken from the original document

managers and staff in order to prioritize those outcomes. Region 3 also uses a modified version of the Kellogg business logic model, modified to accommodate EPA mission and outcomes.

In 2004, EPA Region III used MIRA to evaluate 24 criteria (including air emissions, air quality data, pollution transport, etc.) for the determination of ozone nonattainment areas under the Clean Air Act. This was the first application of the use of MIRA in EPA decision making. Part of the MIRA process included engaging state and industry stakeholders during the construction of the nonattainment analysis. The result of using MIRA in the ozone nonattainment designation process was that Region III's designation decision was not challenged when it was announced.

The MIRA program has been very successful and adoption of this or a similar framework by other regions could facilitate a more integrated and transparent use of science in decision making.

Comment [A5]: Insert an example here.  
Comment [A6]: Make this a highlighted 2x4 box

Rule-making within EPA is a well developed and highly structured and regulated process that has been developed to assure that all of the necessary communication and consideration is given to all aspects of the rule-making process. This process helps assure that science is used appropriately. While the panel found the ADP process to be somewhat linear and would favor a more dynamic process with appropriate feedback loops, the current ADP process has many of the elements of a rigorous and robust decision-making program. Later in the report the panel has provided a proposed structure that could be adapted for use in all levels of the decision-making process.

Due to the high public profile and complexity of superfund sites, and the very technical nature of the risk assessment and remediation processes, EPA has evolved an effective process of integrating the most relevant science into the decision-making process. The Superfund guidance documents lay out an integrated decision-making process that can be used as an effective model for an agency-wide decision framework. The problem formulation process used under the Superfund program is highly evolved and proven. The panel endorses the concept of problem formulation in all of EPA's decision-making processes.

Region 7's Superfund Division cited effective collaboration with ORD's National Risk Management Laboratory in providing point-of-entry and point-of-use water filtration for homes in a community after a Superfund On-Site Coordinator discovered that "people sometimes don't use bottled water" provided by the Region. The coordinator brought this practical concern to the attention of the "Regional Decision Team" of risk assessors, the site manager, and counsel. The ORD National Risk Management Research Laboratory responded to the need to provide the filtration system, a more effective source of water that addressed both inhalation and ingestion routes of exposure.

EPA is confronted with many different issues and legislative constraints. This means that the process used in the various situations where scientific information is applied in the decision-making process needs to be flexible. There is no one specific structure that would be appropriate in all situations. However, that does not mean that every decision is unique. If each decision is considered to be unique the committee finds that the result is a process devoid of structure which

leads to the perception that it is arbitrary and that science is not properly considered in the process. To avoid this perception in the future, it is suggested that EPA adopt a flexible framework that can be tailored to all situations, but that includes all of the elements of sound decision-making.

There is a well developed science of decision-making and experts are available to advise on how to develop a rigorous framework for decision making. The panel finds that including science in the decision-making process is not unique relative to other important elements of the process. What is important that science, like other elements of the process be included at the appropriate points in the process. The decision framework needs to be dynamic and the panel suggests a process of problem formulation that facilitates communication and involves the appropriate elements at the appropriate time in the process.

The facilitation of good decision making is about communication and getting the right elements and or person involved in the process at the appropriate times.

While frameworks for decision making and the inclusion of science in that process are available within EPA and are applied, the panel found that the use of these frameworks is uneven across programs, regions and levels of decision-making within the agency.

Regardless of what frameworks are in place, if they are not used they cannot be effective. It is understood that EPA operates within an uncertain and ever-changing environment where technologies and scientific information are evolving and the social context within which decisions are made is also changing. Therefore, having a decision framework that can be used as a “road map” is important. Such guidance can lay out in advance the steps to be taken under different conditions. The most important aspect of the model development will be the facilitation of pathways and networks of communication so that the most appropriate science can be brought to bear on a given topic. Due to the dynamic nature of how decision need to be made in real time, it is often difficult to seek out the appropriate scientific information during a “crisis”. The scientific coordinators embedded in the regions have a critical role to plan and this function is enforced. The panel observed that while these individuals are very capable scientists and extremely dedicated individuals, they are often burdened with many duties that make it impossible for them to be effective in developing the sorts of networks to coordinate collecting the most relevant science during the decision-making process. While it is recognized that that resources are limited, any steps that can be taken to facilitate the abilities of these individuals to build the necessary pathways of communication and remain current with the state of the science should be fostered.

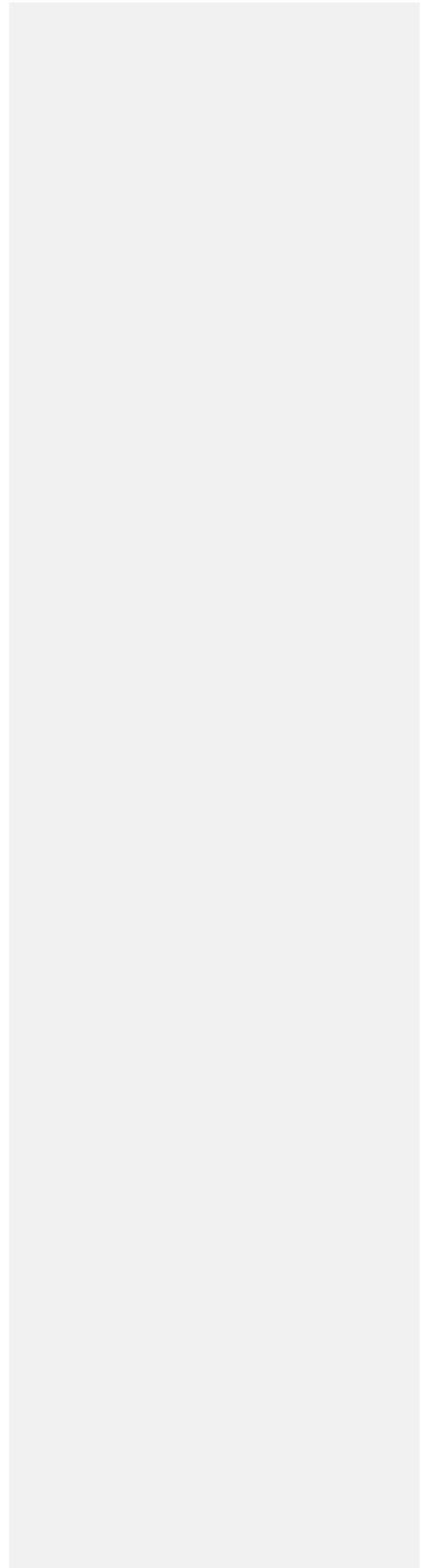
Comment [A7]: This may not be the correct term.

Some overall conclusions:

While frameworks and guidance exist, they are frequently not used, thus leading to an ad hoc gathering of science to be brought to bear in the decision-making process.

The agency should develop a flexible framework to guide decision-making that includes callouts to where scientific information, both the natural and social sciences are integrated into the decision-making process. To be effective such guidance needs to be applied across the agency at

all levels of decision-making. Having such a decision tree or road-map in place will facilitate the application of appropriate science during what is often an accelerated decision-making process. Having such a framework articulated will also facilitate communication with the various publics with which the EPA must deal and will maximize transparency and minimize the potential for criticism. Appropriate frameworks already exist with EPA and outside EPA. It is suggested that the existing frameworks be utilized more uniformly throughout EPA.



## Attachment D: Draft findings and recommendations

### **Process (problem formulation)**

Finding: The agency has effectively used problem formulation processes in some of its programs, but these are not consistently used throughout the agency in its decision making processes.

Recommendation: The agency should adopt problem formulation processes with the following components: sponsor (decision-maker - the program office or regions that use the science – that asks the initial questions), a plan of action and assessment, stakeholder engagement (...), assessment teams (right mix of expertise), (list from Tom T)Strategy

Finding: Agency has several formal tools to facilitate the integration of science in decision making. Examples include multiattribute criteria integrated research assessment, (list from other team)

Recommendation: We strongly encourage the implementation of integrated transdisciplinary research approach throughout ORD, and parallel approaches for the regions and program offices to transdisciplinary work for decision making.

### **Structure**

Finding: A major barrier to science integration is a “silo” approach to implementing individual programs, rather than a consistent effort to find ways EPA can achieve its broader integrated mission to protect human health and the environment.

Recommendation: The agency should institute structures, supported by tools and incentives, that foster the integration of science into its decision making processes.

Finding: There is a tension between regions and programs desire and need for ORD’s products and expertise, and ORD’s vision of this work.

Recommendation: EPA should fashion institutional structural partnerships among the regions, program offices and ORD to be more responsive to the scientific needs for decision making.

### **Human Resource and Expertise**

Finding: EPA needs to incentivize a human resource program that sustains a culture of scientific support for regulatory decision-making. Programs that would encourage exchanges of ORD scientists with program and regional offices, and *vice versa* could also facilitate the development of this culture.

Recommendation: The agency should increase the incentives (e.g., awards, performance evaluations, rewards), for scientists to support the translation and integration of science into decision making.

Finding: Leadership within the agency should be developed to foster integration. There should a formalized program to identify and groom future leaders, that include diverse experiences in the agency.

Recommendation: Career ladders for managers and science leaders would better foster integration if such professionals were expected to work in regions, ORD and program offices.

Finding: Integrated transdisciplinary research and decision-making can best occur when the optimal mix of scientific expertise is engaged in the analysis and deliberation.

Recommendation: EPA should ensure its hiring and contracting practices make available the right mix of critical expertise, including in the social and behavioral sciences.

## Materials Cited

The following meeting materials are available on the SAB Web site, <http://www.epa.gov/sab>, at the page for the [March 29-30, 2011](http://www.epa.gov/sab) meeting: <http://yosemite.epa.gov/sab/sabproduct.nsf/a84bfee16cc358ad85256ccd006b0b4b/194e16d4e3d5386b852577f4007c5177!OpenDocument&Date=2011-03-30>

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<sup>1</sup> Roster of the SAB Committee on Science Integration for Decision Making

<sup>2</sup> Agenda

<sup>3</sup> Comments provided by Richard Becker on behalf of the American Chemistry Council.

<sup>4</sup> Comment from Robert Schreiber

<sup>5</sup> Draft report, *Science Integration for Decision Making*, March 11, 2011 Draft

<sup>6</sup> Robert Schreiber May 27, 2010 comments available at

<http://yosemite.epa.gov/sab/sabproduct.nsf/MeetingCal/266562906BCF3B0B852576DD0067F2E3?OpenDocument>

<sup>7</sup> CREM information - Email provided by Noha Gaber March 29, 2011; CREM White Paper - Integrated Modeling for Integrated Environmental Decision Making; and Administrator's response (04/21/09) to NACEPT letter re: White Paper on Integrated Modeling for Integrated Environmental Decision Making,

<sup>8</sup> Paul Anastas "Path Forward Memorandum," posted on the ORD intranet site on March 4, 2010

<sup>9</sup> Comments from Dr. Edward V. Ohanian, Chair, EPA Risk Assessment Forum.

<sup>10</sup> Integrating Ecological Assessment and Decision-Making at EPA: A Path Forward ~ Results of a Colloquium in Response to Science Advisory Board and National Research Council Recommendations.

<sup>11</sup> EPA's Action Development Process: Interim Guidance on Considering Environmental Justice During the Development of an Action.

<sup>12</sup> EPA's Action Development Process; Guidance for EPA Staff on Developing Quality Actions, March 2011

<sup>13</sup> Comments of Brenda Groskinsky, Region 7

<sup>14</sup> Compilation of science integration interview summaries

<sup>15</sup> Lisa Matthews email (3.30.11) describing Science Policy and Technology Council with STPC charter

<sup>16</sup> SAB Advisory Report "Preparing for Environmental Disasters" (EPA-SAB-09-002).

<sup>17</sup> Improved Science-Based Environmental Stakeholder Processes A Commentary By The EPA Science Advisory Board (EPA-SAB-EC-COM-01-006)