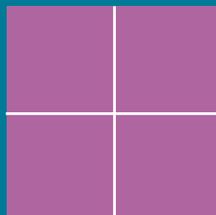


Science Advice for EPA: The Path Forward

The EPA Science Advisory Board Staff Office and Science Advisory Committees Accomplishments Report for Fiscal Years 2003-2004



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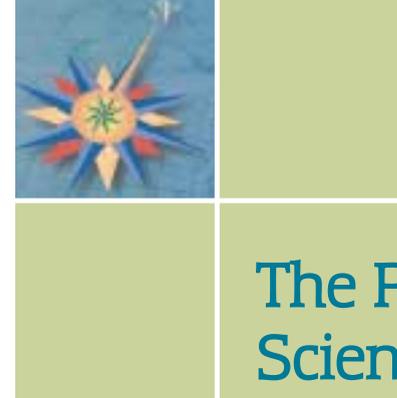


At EPA, our major tasks are to protect and safeguard the nation's environmental resources. In order to achieve this goal, EPA must rely on the highest quality science available for decision making. The three scientific advisory committees whose accomplishments are described in this report have helped strengthen Agency decision making and will help us build a stronger scientific base for future decisions.

I believe that the best environmental decisions are based on sound science, coupled with common sense and open participation from our stakeholders. EPA depends on open, credible scientific processes, which are the essence of work undertaken by the committees supported by the Science Advisory Board Staff Office.

Peer review that uses credible, independent scientists has helped EPA establish underlying facts and build a common ground for collaboration. Independent scientists serving on our chartered advisory committees and their panels provide review of important Agency strategies such as the *National Ambient Air Monitoring Strategy* or key agency guidance such as the recent *Supplemental Guidance for Assessing Cancer Susceptibility from Early-Life Exposure to Carcinogens*. Scientific advisory committees not only help build this solid foundation through peer review, they also provide independent, wide-ranging advice that stimulates the Agency to take new directions. Over the past two years, EPA has received advice in new, important science topics as different as computational toxicology, analyses of the effects of toxicants in embedded sediments, and approaches that could be used for leach testing of wastes. With the recent reorganization of the Science Advisory Board (SAB), the Board is now better able to provide forward-looking scientific and technical advice on emerging issues such as nanotechnology and information technology. Ready access to this type of advice helps EPA keep pace with the rapid evolution in science and technology. EPA needs such advice in facing the complex environmental challenges that lie ahead.

Stephen L. Johnson
Administrator



The Path Forward: Science Advice for Strategic Goals

In 2003, EPA published the *2003-2008 EPA Strategic Plan: Direction for the Future*. This plan identified five goals for achieving a healthy, safe environment and seven strategies for achieving those goals. In the past two years, the Clean Air Scientific Advisory Committee (CASAC), the Advisory Council on Clean Air Compliance Analysis (Council), and the Science Advisory Board (SAB)—all chartered federal scientific advisory committees at EPA—provided peer review of agency scientific work products and forward-looking advice to nurture Agency science as it develops. Both efforts were needed to help the Agency make the best use of science in achieving the goals of cleaner and safer air, water, and land and protection of healthy communities and ecosystems.

To provide early, strategic advice for Agency science and to provide peer reviews of well-developed Agency work products, the CASAC, Council, and SAB provided advice in Fiscal Years (FYs) 2003-2004 through several mechanisms;

- **Consultation**—A public session in which a panel of knowledgeable experts discusses a technical topic before the Agency begins substantive work on that particular subject.
- **Advisory**—A report summarizing the deliberations of one or more public sessions in which panel members provide advice on technical issues. These public sessions take place at the same time as the Agency is developing its position on a topic.
- **Peer Review**—A report summarizing the deliberations of one or more public sessions in which panel members review a completed Agency product.

Goals of the Agency's 2003 Strategic Plan

- Clean Air
- Clean and Safe Water
- Land Preservation and Restoration
- Healthy Communities and Ecosystems
- Compliance and Environmental Stewardship

- **Commentary**—A short communication issued primarily by the SAB that provides unsolicited advice about an important technical issue.
- **Other Activities**—The SAB, CASAC, Council, and their subcommittees often receive information briefings from the Agency. The SAB also conducts scientific workshops and undertakes original studies as deemed appropriate or requested by the Agency.



Highlighting Key Accomplishments in FY 2003 and FY 2004

Letter from the Past Chair of the Science Advisory Board

In November 2003, EPA announced the reorganization of the SAB, an institution with twenty-five years of accomplishments in advising the Agency on the science needed for environmental protection. From my perspective as chair of the SAB since 2000, I believe these changes will increase the ability of the SAB to provide high-quality, independent advice that responds to the Agency's current priorities and anticipates future needs. Indeed, I believe that they have already begun to do so.

There are two key features of the SAB reorganization. A Board, composed of 25 to 30 Members appointed by the Administrator, has responsibility for strategic advice and final approval of SAB reports. New quality review committees, aided by additional experts, are formed as needed to review high-priority reports authored by SAB committees and peer review panels before the Board's final review and approval. These changes will help the Board and the Agency keep pace with the rapid advancement of science and technology by enabling the Board to focus on emerging scientific issues. The reorganization will assist us in providing on a timely basis the kind of thoughtful, insightful advice that the Agency needs while ensuring peer review processes that follow the highest standards. I also believe that the reorganization will help the Board attract the best scientific minds in our society to provide this advice.

Many members of the Board and staff have invested hours of time and much energy in working with the Agency and the many interested members of the public interested in this important reorganization. I would like to thank them and the staff, especially the Director, Dr. Vanessa Vu, and the SAB's own Reorganization Subcommittee for their insights and time invested in the future of the Board.

William H. Glaze, Professor
OGI School of Science & Engineering,
Oregon Health and Science University
SAB Chair (2000-2004)



Strengthening the Process for Providing Advice

Letter from SAB Staff Office Director

The SAB Staff Office, housed within EPA's Office of the Administrator, performs management and administrative functions and provides technical assistance to the CASAC, the Council, and the SAB, which are all separately chartered federal advisory committees providing scientific and technical advice to EPA. The Staff Office serves as the interface for these advisory bodies in their interactions with EPA and the public. The Staff Office also ensures that the CASAC, the Council and the SAB conduct advisory activities as part of a public process that meets the sunshine requirements of the Federal Advisory Committee Act (FACA) and the requirements of the Ethics in Government Act. We ensure that the public has an opportunity to provide input during the advisory process.

Over the past two years the Staff Office has focused on charting a path forward for the federal advisory committees and for enhancing the advisory process by strengthening the public involvement process, by addressing policy and legal issues, and by strengthening the staffing and infrastructure supporting key science advice. To assist the SAB in keeping pace with complex environmental challenges facing the Agency, the SAB Staff Office recommended the structural and functional realignment of the SAB; this new direction was approved by the Administrator in November 2003. The Staff Office also developed an *Implementation Plan for the New Structural Organization of the EPA Science Advisory Board* (EPA-SAB-04-002). This document, available on the SAB Web site (www.epa.gov/sab), describes how the SAB Staff Office is implementing the new structural and functional changes in the SAB.

It has been an intense, rewarding, and challenging two years. We managed changes in the SAB structure and committee processes and also supported the committees in providing early, forward-looking advice and rigorous peer reviews of EPA technical and scientific work products that directly impact major EPA policies and decisions. This *Accomplishments Report* illustrates how the advisory committees have responded to the Agency's need for science advice that supports EPA's three major goals of protecting air, water, and land, as well as the need for advice to guide Agency science planning and science policy decisions. I thank all our advisors for their work, most especially the chairs of our advisory committees, for their insights and their commitment to the work of the Agency.

Vanessa T. Vu, Ph.D.
Director



Key Advice in FY 2003-2004

This report highlights examples of key advice provided by the federal advisory committees on important scientific and technical issues specific to EPA's goals of clean air, clean and safe water, and land preservation. These examples illustrate how committees have helped the Agency plan for its science needs and for the integration of science in policy decisions. The examples below also include responses from the Agency describing the usefulness and impact of the advice received. A look at the committee and panel chairs that steer the major projects gives a sense of the range of expertise and experience of the scientists who serve the Agency through the CASAC, Council, and SAB.

Goal 1: Clean Air

Congress mandated the establishment of the CASAC and the Council to provide ongoing advice to EPA on scientific and technical issues relating to clean air. The CASAC was established under the Clean Air Act Amendments of 1977 (42 U.S.C. § 7409(d)(2)) to provide advice, information, and recommendations to the Administrator on the scientific and technical aspects related to the criteria for air quality standards, research related to air quality, sources of air pollution, and the strategies to attain and maintain air quality standards and to prevent significant deterioration of air quality. The Council was established under the Clean Air Act Amendments of 1990 (42 U.S.C. § 7612) to provide advice, information, and recommendations on the

technical and economic aspects of analyses and reports EPA prepares concerning the impacts of the Clean Air Act on the U.S. economy, public health, and the environment

Over the past two years, both committees worked intensively to provide advice on the data and analyses to be used by EPA's Office of Air and Radiation. These committees also serve as peer reviewers



for major scientific and technical work products. In addition, both committees have strengthened their expertise in the area of ecological assessment since publication of the last *Accomplishments Report* for FY 2002. The SAB Staff Office formed an Ecological Effects Subcommittee (EES) of the Council in 2004. The EES, chaired by Dr. Charles Driscoll of Syracuse University, was established to provide advice to the Agency through the Council to strengthen the Agency's assessments of the ecological effects of implementing the Clean Air Act. Ecological expertise on the CASAC was also augmented by the appointment of Dr. Ellis B. Cowling of North Carolina State University.

Highlighted below are examples of CASAC and Council projects that focused on different aspects of science underlying EPA's clean air goal.

Clean Air Scientific Advisory Committee Review of the Agency's National Ambient Air Monitoring Strategy (EPA-SAB-CASAC-LTR-04-001)

In this 2004 report, CASAC reviewed EPA's Draft National Ambient Air Monitoring Strategy (NAAMS). This strategy was developed through partnerships between

THE VALUE OF THIS DIALOGUE BETWEEN OUR PROGRAM SPECIALISTS AND SCIENTIFIC EXPERTS AT THE INITIAL STAGE OF A PROJECT SHOULD REAP ENORMOUS LONG-TERM BENEFITS FOR OUR MONITORING NETWORKS.

EPA (Office of Air Quality Planning and Standards, Office of Research and Development, and regional offices) and tribal, state, and local agency representatives. The draft strategy proposed a restructuring of air monitoring networks to meet current and projected future needs. The CASAC report commended the Agency for its critical evaluation of ongoing air monitoring programs and stated that a properly reconfigured air-monitoring network will provide better information for making air-quality management decisions. The two principal suggestions regarding the draft strategy were to: 1) establish priorities for monitoring objectives and 2) develop guidance to ensure that monitoring network assessments were reasonably uniform across regions and states. The CASAC requested that

the draft strategy be revised to reflect its recommendations and be resubmitted to CASAC for review.

Excerpt from Agency response from Administrator Michael O. Leavitt:

"On behalf of everyone involved in the strategy's development, I applaud the constructive advice provided by your committee. The value of this dialogue between our program specialists and scientific experts at the initial stage of a project should reap enormous long-term benefits for our monitoring networks.

"We have reviewed all of the committee's recommendations and are in the process of incorporating your advice in the revised National Ambient Air Monitoring Strategy document, as well as in forthcoming modifications in the air monitoring regulations."



Dr. Philip Hopke
Chair: Clean Air Scientific
Advisory Committee

Dr. Philip K. Hopke is the Bayard D. Clarkson distinguished professor at Clarkson University and the director of the Center for Air Resources Engineering and Science.

Professor Hopke is the immediate past president of the American Association for Aerosol Research and was a member of the National Research Council's congressionally mandated Committee on Research Priorities for Airborne Particulate Matter and the Committee on Air Quality Management in the United States. He is a member of the National Research Council's U.S. Committee on Energy Futures and Air Pollution in Urban China and the United States. Professor Hopke received his B.S. in Chemistry from Trinity College (Hartford) and his M.A. and Ph.D. degrees in chemistry from Princeton University. After a post-doctoral appointment at M.I.T., he spent four years as an assistant professor at the State University College at Fredonia, NY. Dr. Hopke then joined the University of Illinois at Urbana-Champaign and subsequently came to Clarkson in 1989 as the Robert A. Plane Professor with a principal appointment in the Department of Chemistry. He has served as dean of the Graduate School, chair of the Department of Chemistry, and head of the Division of Chemical and Physical Sciences before he moved his principal appointment to the Department of Chemical Engineering in 2000.

Review of the Draft Analytical Plan for EPA's Second Prospective Analysis — Benefits and Costs of the Clean Air Act, 1990-2020: An Advisory by the Advisory Council for Clean Air Compliance Analysis (EPA-SAB-COUNCIL-ADV-04-004)

In this review the Council addressed overarching charge ques-

tions concerning the analytical framework for the analysis related to the economic impacts of the Clean Air Act on public health, the economy, and the environment. This work built upon reports provided by the Council's Air Quality Modeling Subcommittee (2003) and Health Effects Subcommittee (2004) on emissions estimation

and health effects analysis included in the Draft Analytical Plan for EPA's Second Prospective Analysis.

The Council underscored the importance of the Agency's analysis of the benefits and costs of the Clean Air Act. Council members considered the analysis important for guiding decisions about future regulations, legislation, and strategic planning. It regarded the Agency's analyses as an "ambitious and difficult enterprise that pushes the Agency to the frontiers of science in many different disciplines." To foster the research and development of methods needed, the Council advised the Agency to create a "Learning Laboratory" to test methods needed to improve analyses.

The Council highlighted several technical points of major importance to the Office of Air and Radiation and to the Agency in general. Members provided advice on how the Agency can best address uncertainty in both its costs and benefits estimates and emphasizes the importance of choosing consistent and compatible modeling assumptions. In regard to discounting, the Council advised the Agency to employ a range of values for the social discount rate and advised the Agency to make progress in using computable general equilibrium

models to reveal the indirect consequences of air quality regulations that spill over into unregulated sectors. The Council also provided advice regarding the Agency's choice of a key parameter, the value of a statistical life, given the limitations and uncertainties of information available to the Agency. Council members advised the Agency not to include any cost-effectiveness analysis, including quality-adjusted life-years, in the main analysis, which is defined by statute as a benefit-cost analysis.

Excerpt from Agency response from Administrator Michael O. Leavitt:

"I applaud the thoroughness and technical sophistication of your advisory, and I appreciate the Council's ongoing efforts to provide high-quality advice regarding the design and implementation of this important series of studies. Given the substantial scope and depth of the advisory, EPA will respond by taking specific actions to address and implement the report's recommendations through the redirection of our analytical efforts. These analytical changes will be reflected in the first draft of the study report, which will be submitted to the Council for review. In addition, EPA



Dr. Trudy Ann Cameron
Chair: Advisory Council on
Clean Air Compliance Analysis

Dr. Trudy Ann Cameron is the Raymond F. Mikesell professor of environmental and resource economics at the University of Oregon. She holds a Ph.D. in economics from Princeton University and was a mem-

ber of the faculty in economics at the University of California, Los Angeles, for seventeen years before moving to the University of Oregon in January 2002. She has served as a member of the board of directors, as well as vice-president, of the Association of Environmental and Resource Economics and as an associate editor for the *Journal of Environmental Economics and Management* and the *American Journal of Agricultural Economics*. She has also served on the Environmental Economics Advisory Committee of the SAB and the Economics and Assessment Working Group of the EPA's Children's Health Protection Advisory Committee. Dr. Cameron's research concentrates on the methodology of non-market resource evaluation, with special emphasis on econometric techniques for the analysis of stated preference survey data. Her recent projects have included a study of popular support (i.e., willingness to pay) for climate change mitigation programs (funded by the National Science Foundation). Another current project uses stated preference survey methods to elicit household choices that reveal willingness to pay to avoid illness, injury, and death. The value of a statistical life is a key ingredient in the benefit-cost analysis of many environmental, health, and safety regulations, and this project seeks to more clearly identify how the context of such choices influences the public's willingness to pay for such policies.

anticipates conducting additional interim consultations with the Council and its subcommittees,

during which the project team will describe EPA's efforts to address all the key elements of your advisory."

Goal 2: Clean and Safe Water

Among the many activities begun, completed, and under way over the past two years related to the goal of Clean and Safe Water, this *Accomplishments Report* highlights the establishment of a consultative panel of the SAB's Ecological Processes and Effects Committee (EPEC) to provide early strategic advice related to risks from pollutants embedded in sediments. In addition, the SAB's Drinking Water Committee addressed key human health impacts facing EPA's Drinking Water Program and received briefings on upcoming projects for future fiscal years.

EPA's Strategy on Suspended and Bedded Sediments: An EPA Science Advisory Board Notification of a Consultation (EPA-SAB-EPEC-CON-04-002)

The SAB's Ecological Processes and Effects Committee met on October 21, 2003, to conduct a consultation on a discussion paper representing EPA's initial thinking concerning a strategy for developing water-quality criteria for suspended and bedded sediments. Agency staff at the consultation expressed hopes for

moving forward to an implementation strategy similar to the nutrient strategy and biological criteria strategy currently in use. Committee members provided advice on eight potential approaches or tools for these criteria including toxicological criteria, relative bed stability, conditional probability, state-by-state reference condition, fluvial geomorphic approaches, water body functional criteria, new criteria efforts, and approaches for synthesis or combination of criteria. Committee members presented a range of views on the advantages and disadvantages of different methods for different ecological conditions and discussed various means of synthesizing the approaches presented.

Agency Response from Dr. Edward Ohanian, Director, Health and Ecological Criteria Division, Office of Science and Technology, Office of Water: "Our program received key recommendations from the consultation that confirmed the validity of the proposed approaches for suspended and bedded sediments and the usefulness of suggested implementation tools. Committee members confirmed the synthesized approach envisioned, based on reference conditions that include elements of all other tools suggested by staff, and the conditional probability technique for analyzing field data and setting thresholds. It was beneficial to hear that any criteria approach should show a strong link

between the measurement of sediment and biological conditions.

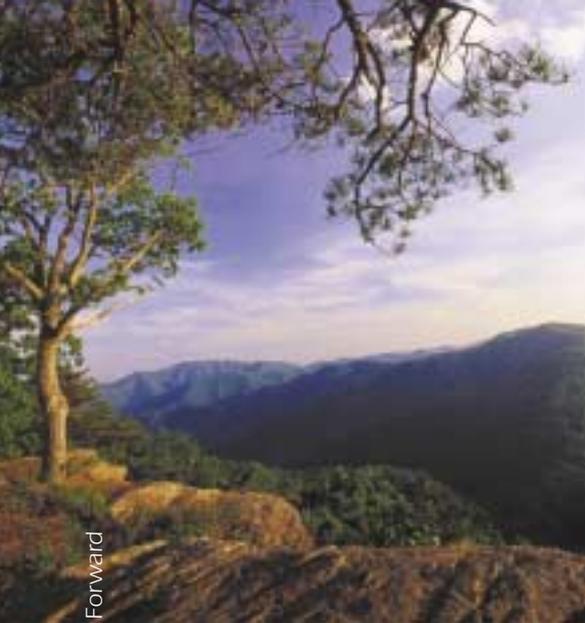
"It was also helpful to receive the suggestion that criteria should be developed by each major water body type, including lakes, estuaries, wetlands, rivers, streams, and headwaters, and then tiered by classes of similar water body types within each of these major categories (e.g., cold clear-water mountain streams). Committee members also encouraged that the methods and tools be understandable to the community that will implement the criteria and show consistency across the country.

"Given the confirmation of the proposed Office of Water approach to criteria for suspended and bedded sediments, the Office of Water plans to develop a draft National Suspended and Bedded Sediments Strategy and make it available for public review by spring 2005."



Dr. Virginia Dale
Chair: SAB Ecological Processes and Effects Committee

Dr. Virginia Dale is a landscape ecologist at Oak Ridge National Laboratory and adjunct faculty member in the Department of Ecology and Evolutionary Biology at the University of Tennessee. She received her Ph.D. from the University of Washington in mathematical ecology in 1980. Dr. Dale's primary research interests are in environmental decision making, forest succession, land-use change, landscape ecology, and ecological modeling. She has worked on developing tools for land management; vegetation recovery following the eruption of Mount St. Helens; forest development subsequent to insect outbreaks, fires, windthrows, and clear-cutting; effects of air pollution and climate change on forests; tropical deforestation in Asia and Latin America; and integrating socioeconomic and ecological models of land-use change. Dr. Dale serves on the Science Advisory Board for the Grand Canyon Monitoring and Research Center and the Committee on Ecological Effects of Road Density of the National Academy of Sciences. She is the chair of the U.S. Scientific Committee for Problems of the Environment for the National Academies of Sciences. Dr. Dale has served on the National Academy of Sciences Ecosystems Panel, the Committee of Scientists appointed by the Secretary of Agriculture, and the several panels that review proposals submitted to the National Science Foundation. She was chair of the U.S. Regional Association of the International Association for Landscape Ecology and has been on the Governing Board of the Ecological Society of America. She is currently on the editorial board for the journals *Ecological Economics* and *Ecological Indicators*. She is also the editor-in-chief of *Environmental Management*.



Goal 3: Land Preservation and Restoration

Highlighted below are two projects completed in FY 2003-2004 related directly to land preservation and restoration. One provided early consultative advice on an important testing procedure for wastes. Another addressed a complex modeling effort developed in a partnership between EPA's Office of Solid Waste and Emergency Response and the Office of Research and Development. In addition, the Board provided advice on science planning related to contaminated sediments and contaminated sites, important science issues for Goal 3.

Improving Leach Testing of Waste: An EPA Science Advisory Board Notification of a Consultation (EPA-SAB-EEC-CON-03-006)

The SAB's Environmental Engineering Committee met on June 17-18, 2003, to conduct a consultation with staff and managers from the Environmental Protection Agency's Office of Solid Waste and the Office of Research and Development to discuss the improvement of waste material leaching evaluation in waste management situations where the Toxicity Characteristic Leaching Procedure is not required by regulation. Alternatives to the procedure are of key interest to EPA in contaminated site remediation, waste material reuse, and hazardous waste delisting situations.

EPA has initiated internal research and supported external research to work toward a more comprehensive assessment framework and set of testing protocols to evaluate the leaching potential of waste materials under specific environmental conditions. Important conditions include those found in the course of waste disposal and reuse, as well as contaminated site remediation. This consultation was designed to consider alternatives to

the procedure that could improve environmental decision making when regulatory programs allow such flexibility.

In the consultation, EPA was primarily interested in SAB's thoughts on the scientific strengths and potential applicability of a tiered framework for leaching assessment developed by researchers at Vanderbilt University, with partial support from the Office of Solid Waste. EPA also sought SAB's advice on the direction for long-term research to develop a better fundamental understanding of leaching processes for improved tests and predictive models.

Committee members generally agreed that alternatives to the Toxicity Characteristic Leaching Procedure for the evaluation of leach potential are needed for some waste and site situations, but it was not clear if there are a large or small number of situations for which an alternative approach is needed. They commented on a specific existing framework that was broadly applicable and specified where more development work was needed. The Committee provided guidance on how to focus investment in science in the most applicable waste and site situations and possible reuse scenarios to strengthen the work on alter-

natives. Members also suggested opportunities to work with others, including the Department of Defense, Department of Energy, and the Federal Highway Administration to make the best use of limited research and development resources.

Agency Response from Mr. Robert Dellinger, Director of the Hazardous Waste Identification Division, Office of Solid Waste and Emergency Response:

"This consultation was conducted at the request of the Office of Solid Waste and Emergency Response (OSWER) as part of an ongoing discussion between the office and the SAB on the best approaches to the use of leach testing to evaluate the likely environmental impacts of waste management. In earlier reviews of Agency leach testing (in 1991 and 1999), the SAB had urged the Agency to expand its waste leaching research program and to improve and identify alternatives to the currently used leaching test, the Toxicity Characteristic Leaching Procedure. The SAB was concerned, in large part, that the procedure was used too broadly and in circumstances where it was not expected to perform well.



Dr. David Dzombak
Chair: SAB Leaching Consultation

Dr. David A. Dzombak is professor of civil and environmental engineering at Carnegie Mellon University, a registered professional engineer in Pennsylvania, and a diplomate of the American Academy of Environmental Engineers. He holds a Ph.D. in civil-environmental engineering from the Massachusetts

Institute of Technology. The emphasis of his research is on water and soil quality engineering, especially the fate and transport of chemicals in subsurface systems and sediments, wastewater treatment, *in situ* and *ex situ* soil/sediment treatment, hazardous waste site remediation, and abandoned mine drainage remediation. Dr. Dzombak has served on the National Research Council Committee on Bioavailability of Contaminants in Soils and Sediments and on various research review panels for the Department of Defense, Environmental Protection Agency, National Institute of Environmental Health Sciences, and the National Science Foundation. He has also served on the Board of Directors and as an officer of the Association of Environmental Engineering and Science Professors; as chair of committees for the American Academy of Environmental Engineers, American Society of Civil Engineers, and Water Environment Federation; and on advisory committees for various community and local government organizations and for the Commonwealth of Pennsylvania. Dr. Dzombak was elected a fellow of the American Society of Civil Engineers in 2002. Other recent awards and honors include the Professional Research Award from the Water Environment Association of Pennsylvania in 2002, an Aldo Leopold Leadership Program Fellowship by the Ecological Society of America and the David and Lucile Packard Foundation in 2000, and the Jack Edward McKee Medal from the Water Environment Foundation in 2000.

"As a result of the concerns expressed by SAB, as well as the occurrence of several instances in which the procedure performed

poorly, the Agency expanded its efforts to understand and account for through testing the factors that affect waste constituent leaching.

After several years of this effort, OSWER sought feedback from the SAB in the form of a consultation, particularly regarding the scope and general direction of the work. As a result of that consultation, OSWER has continued to work with academic researchers on testing approaches that consider the effects of pH, test liquid-to-solid ratio (infiltration rate), and the effect of the physical form of the waste on metals leaching. We have also begun to work on field validation studies of this testing approach, a significant recommendation of the SAB panel. In future work we hope to address other factors affecting metals leaching (such as oxidation/reduction conditions) and begin to more closely examine leaching of organic chemicals while addressing other SAB recommendations.”

EPA's Multimedia, Multipathway, and Multireceptor Risk Assessment (3MRA) Modeling System; A Review by the 3MRA Review Panel of the EPA Science Advisory Board (EPA-SAB-05-003)

The SAB found that the 3MRA modeling system is a major step forward in providing a flexible and consistent tool for estimating the distributions of the probability of

exceeding adverse effect benchmarks, resulting from various choices of thresholds used to evaluate wastes for exemption from Subtitle C of the Resource Conservation and Recovery Act (RCRA). Used in conjunction with other factors, 3MRA provides a scientifically defensible framework that gives reproducible results for determining national levels for RCRA-listed hazardous wastes. The SAB commended the manner in which 3MRA was developed as a genuine cross-Agency partnership between the Office of Solid Waste and the Office of Research and Development. It is clear that the developers of 3MRA were acutely aware of the need to address criticisms of previous modeling attempts.

To maintain the value, utility, and credibility of 3MRA, the SAB recommended that the Agency support the continued development of the 3MRA modeling system. In order to maximize the long-term utility and vitality of the model as improved information becomes available, the panel recommended that the Agency articulate a plan for updating both the databases that support the model, as well as the individual model components.

Agency Response from Dr. Rosemarie C. Russo, Director, Ecosystems Research Division, National Exposure Research Laboratory, Office of Research and Development, and Mr. Gary Ballard, Acting Associate Director, Economics, Methods and Risk Analysis Division, Office of Solid Waste and Emergency Response:

“The SAB review was critically important because 3MRA represents the first comprehensive and integrated risk assessment technology for assessing human health and environmental impacts related to programs under the Resource Conservation and Recovery Act. The review establishes that modeling systems like 3MRA and the underlying science are worthy of investment and development not only within the EPA community, but also across the federal agencies and private sector. For a number of years there had been significant apprehension and debate on the part of the multimedia modeling community as to whether policy, technology, science, and application could come together into a workable, practicable, and scientifically sound model. The 3MRA model and the associated in-depth SAB examination showed that such development had occurred and the multimedia modeling community could move forward with such tools.

In short, the independent support and acknowledgement of this SAB review suggest that the Agency is on the right track and as such may well provide the direction and signal that is needed to launch the environmental research and policy communities toward investment in and development of the next generation of multimedia modeling tools.

“The SAB review highlighted a number of innovative approaches and tools associated with the 3MRA development and regulatory applications. These include elevating probabilistic ecological risk assessment on par with human health risk assessment; using census data and similar information to go beyond individual risk point estimates and instead construct valid estimates of the distribution of individual risks across a population in space and time; developing a software technology designed for 100 percent reproducibility and quality assurance that houses, manages, and reports enormous amounts of information on a PC platform; developing scientifically sound evaluation protocols for models where it is physically impossible to validate in the field; and developing risk-based standards that no longer rely on the most driving exposure path-



Dr. Thomas L. Theis
Chair: SAB Multimedia Multipathway Multireceptor Risk Assessment (3MRA) Modeling System Panel

Professor Thomas L. Theis is the director of the Institute for Environmental Science and Policy, a cross-disciplinary unit dedicated to promoting collaborative research on the environment, at the University of Illinois at Chicago. His areas of expertise include the mathematical modeling and systems analysis of environmental processes, the environmental chemistry of trace organic and inorganic substances, interfacial reactions, subsurface contaminant transport, hazardous waste management, industrial pollution prevention, and industrial ecology. He has been principal or co-principal investigator on more than fifty funded research projects totaling in excess of \$10 million and has authored or co-authored over one hundred papers in peer-reviewed research journals, books, and reports. He is a former editor of the *Journal of Environmental Engineering*. From 1980 to 1985 he was the co-director of the Industrial Waste Elimination Research Center (a collaboration of the Illinois Institute of Technology and the University of Notre Dame), one of the first centers of excellence established by the EPA. In 1989 he was an invited participant on the United Nations Scientific Committee on Problems in the Environment for its workshop on groundwater contamination. In 1998 he was invited by the World Bank to assist in the development of the first environmental engineering program in Argentina. He is the founding principal investigator of the Environmental Manufacturing Management Program, one of the Integrative Graduate Education Research and Training grants of the National Science Foundation.

way but instead jointly and simultaneously consider all pathways.

“With respect to the conduct of the review itself, the Agency is particularly pleased that the panel devoted so much effort to this

review. Because more than 45 peer reviews of individual 3MRA science models had already been completed, the SAB panel was asked to focus its attention on the integrated 3MRA science and technology “system”

with special emphasis on the national risk assessment methodology. When the panel determined that a quality systems level review was not possible without a thorough understanding of the individual components (i.e., science models) they dedicated significant extra time and energy to developing this understanding. The result was not only a well-informed system level review, but also a comprehensive review of the science components of 3MRA from the integrated systems perspective. Through this review the panel has provided valuable insight and recommendations that the Agency will consider in the context of implementing the model for its regulatory assessment programs.”

Science Planning

The SAB's process for providing advice on science and research planning at EPA changed in 2004 as a result of the reorganization of the Board and in response to changes in science planning at EPA. The Board's reorganization and associated *Implementation Plan* emphasized the importance of providing strategic advice to shape future science at EPA. Advice on science and research planning

became a priority for the chartered SAB and for SAB standing committees. The SAB Staff Office organized a set of SAB advisory activities to respond to the complex set of research planning efforts designed by the Agency to implement the 2003 EPA *Strategic Plan*, to provide advice timed to the annual science and research planning process mandated by the congressional budget cycle, and to respond to emerging science needs.

The SAB advice on EPA's science planning had three main components. The major component was the chartered SAB's work with EPA representatives to acquire information systematically on Agency science and research programs. Drawing on the experience of its *ad hoc* and standing committees, the SAB expanded its scope of advice on EPA's annual science and research budget in FY 2004 to include all Agency science and research, not only the investments in EPA's Office of Research and Development. As separate activities that also contributed to that major effort, SAB standing committees reviewed several multi-year plans developed by EPA's Office of Research and Development in collaboration with EPA program and regional offices. In addition, SAB

ad hoc technical panels reviewed draft Agency research plans and science plans

Examples of SAB advice on the topics of science and research budgets and research plans in emerging science areas are highlighted below. Ongoing SAB work for FY 2005 involves review of additional EPA multi-year science plans, as well as overall Agency science and research planning for FY 2006.

Advisory Report on the Science and Research Budgets for the U.S. Environmental Protection Agency for Fiscal Year 2005; A Report by the EPA Science Advisory Board (EPA-SAB-ADV-04-003)

This report provided the Board's advice on the Fiscal Year 2005 budget request for EPA's science and research activities. The SAB affirmed its recognition, after conducting numerous reviews of EPA's science and research activities over more than 20 years, that the Office of Research and Development has a strong cadre of scientists who conduct high quality, diverse scientific research programs that focus on specific EPA missions. The Board viewed Agency scientists, combined with the scientists involved in EPA's extramural programs, as providing

a unique and flexible source of expertise for conducting research in support of informed decision making. Board members communicated concerns about EPA's ability to adequately sustain this important science and research program.

Agency Response from Dr. Kevin Y. Teichman, Director, Office of Science Policy, Office of Research and Development:

“The Science Advisory Board's review of the science and technology budget request for FY 2005 provides many important findings and recommendations. The report is particularly valuable because it presents an integrated review, within the context of the President's Budget request, of the Agency's science programs, how these programs relate within and outside of EPA, and whether the science programs contain the necessary components to achieve the Agency's strategic goals. The advice contained in the report is an important contribution to the planning and implementation of the Agency's science activities. We look forward to continuing to work with the Board to keep its understanding current on the many science activities underway within the Agency. The Board's commitment to examining the actual science activities



Dr. Genevieve Matanoski
Chair: SAB Science and Research Advisory Panel

Dr. Genevieve Matanoski is a professor of epidemiology at the Johns Hopkins University Bloomberg School of Public Health in Baltimore, Maryland. For a time after medical school she pursued a career in pedi-

atrics and general preventive medicine. After earning a doctor of public health degree, she was appointed to the faculty of Johns Hopkins University and has been a professor since 1976. In addition to teaching and research, Dr. Matanoski has held appointments in a number of teaching and training programs in the United States and abroad and is a frequent advisor to legislative and policy making groups. She is a member of several scientific advisory bodies both for governmental agencies and for industry. She is a past chair of the EPA Science Advisory Board as well as a past chair of the SAB Radiation Advisory Committee. During her tenure on the EPA SAB, Dr. Matanoski was involved in the writing of several documents produced by the SAB to provide advice to EPA including the *Beyond the Horizon: Using Foresight to Protect the Environmental Future* and *Toward Integrated Environmental Decision-making*. She is the author or co-author of more than 80 publications. Dr. Matanoski's work has focused on the epidemiology of cancer, including bladder, lung, skin and uterine cancers, and leukemia. Her research studies have examined the risks associated with occupational and environmental exposures to such agents as radiation, electromagnetic fields, and chemical substances such as styrene, butadiene, arsenic and environmental tobacco smoke. Recent research has emphasized reproductive effects and congenital malformations from environmental exposures. Her early work involved infectious diseases and illnesses in infants and children. Dr. Matanoski received a B.A. degree in chemistry at Radcliffe College and an M.D. at the Johns Hopkins School of Medicine and a doctor of public health degree from the Johns Hopkins University School of Hygiene and Public Health.

behind the budget numbers results in increasingly valuable input into

shaping EPA's science and technology program.”

Review of the Draft Human Health Research Strategy for Improving Risk Assessment; Report of the USEPA Science Advisory Board (EPA-SAB-EC-03-010)

The SAB provided advice on four charge questions relating to the strategic directions for the Office of Research and Development's core research program in human health risk assessment. The research directions, outlined in the strategy document, were based on the evaluation of research needs from the Agency's regulatory and regional programs and consideration of recommendations from external advisory groups. The priority research areas include: 1) research on harmonizing risk assessment approaches; 2) research on aggregate and cumulative risk; 3) research on susceptible and highly exposed subpopulations; and 4) research to enable evaluation of public health outcomes.

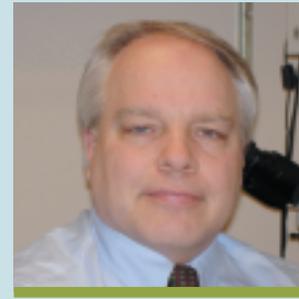
The SAB supported the integrative, multidisciplinary approach that the strategy appears to embrace. It suggested that harmonization will be best achieved by fully considering information on mechanisms/modes of action in risk assessment. The Board recommended that strategic research

planning should focus on advancing such knowledge while recognizing that harmonization does not mean that a single methodology should be used for assessment of all toxicities and pollutants. Focus on aggregate and cumulative exposure and risk is an appropriate and logical next step in the evolution of human health risk assessment. The Board advised the Agency to provide further elaboration on and a more balanced presentation of areas of research needs and, in particular, the allocation of resources necessary for elucidating the events leading up to exposure. To identify susceptible populations, the Board acknowledged the importance of understanding the role of predisposing factors including genetic predisposition, gender, age (partic-



ularly children and the elderly), disease, and immune status in determining how an organism will respond to chemical or physical agents. In addition, the Board recommended that contributory risks should also be included, such as the impact of lifestyle and neuropsychological factors including stress and living conditions, passive or active smoking, and nutrition.

Agency response from Dr. Harold Zenick, Associate Director for Health, National Health and Environmental Effects Research Laboratory, Office of Research and Development: "...thank you and the rest of the review panel of the Science Advisory Board for the excellent and insightful comments concerning the review of ORD's Human Health Research Strategy (HHRS) document. We are pleased that it is the sense of the review panel that the strategic directions described in the document may have a direct impact on the overall focus of the risk assessment research community.... ORD will rely on the comments and judgment of the review panel to draft the final version of the research strategy."



**Dr. James E. Klaunig
Chair, Human Health Research
Strategy Review Panel**

Dr. James E. Klaunig is Professor of Toxicology and Director of Toxicology in the Department of Pharmacology and Toxicology at Indiana University, School of Medicine. He received his B.S. degree from

Ursinus College in Collegeville, Pennsylvania, an M.A. from Montclair State University, Montclair, New Jersey, and his Ph.D. from the University of Maryland in Baltimore, Maryland. He is the recipient of numerous awards, including Fellow of the Academy of Toxicological Sciences; the Otis R. Bowen M.D. Distinguished Leadership Award, Indiana University School of Medicine; the Kenneth P. DuBois Award from the Midwest Society of Toxicology, and the Sagamore of the Wabash award from the governor of Indiana. He is editor-in-chief of *Toxicologic Pathology Journal*, serves as associate editor of *Toxicological Sciences*, and is on the editorial board of *Toxicological Pathology*. He is a member of the National Toxicology Program Board of Scientific Counselors for the National Institutes of Health, National Institute of Environmental Health Sciences. He also has served as president of the Carcinogenesis Specialty Section, president of the Ohio Valley Society of Toxicology, member and chair of the Education Committee, and member of the finance and program committees of the Society of Toxicology. He is currently the treasurer of the Society of Toxicology. He also serves the State of Indiana on the Indiana Pesticide Review Board, the Governor's Council on Impaired and Dangerous Driving, and the Indiana Controlled Substances Advisory Board. He has trained more than fifty graduate students and postdoctoral fellows. His research interests are dedicated to understanding the mechanisms of chemically induced carcinogenesis, specifically the mode of action of nongenotoxic carcinogens; understanding the role of oxidative stress in carcinogenesis and cell injury, and understanding the multistage nature of the cancer process.

Review of the Environmental Economics Research Strategy of the U.S. Environmental Protection Agency; A Report by the EPA Science Advisory Board Environmental Economics Advisory Committee (EPA-SAB-04-007)

In this report prepared by the Environmental Economics Advisory Committee, the SAB focused on five key areas of research, including: 1) valuation of human health; 2) valuation of the ecological benefits of environmental improvement; 3) environmental behavior and decision making; 4) market methods and incentives; and 5) benefits of environmental information disclosure. In general, the Board concluded that the strategy adequately characterizes the major research gaps in the literature for the benefits of human health and ecological risk reduction and that research in these areas could generate high-quality, useful information for EPA in a reasonable timeframe. The Board also recommended that EPA hold workshops, in conjunction with the annual meetings of the American Economics Association and the American Agricultural Economics Association, as a way to achieve a wider distribution for its economics



Dr. Maureen L. Cropper
Chair: SAB Environmental Economics
Advisory Committee

Dr. Maureen L. Cropper is professor of economics at the University of Maryland, a lead economist at the World Bank, and a university fellow at Resources for the Future. She received a B.A. in economics from Bryn Mawr College in 1969 and a Ph.D. in economics

from Cornell University in 1973. Her research has focused on valuing environmental amenities, especially environmental health effects; on the discounting of future health benefits, and on the tradeoffs implicit in environmental regulations. Her recent research focuses on factors affecting deforestation in developing countries and on the externalities associated with motorization. Dr. Cropper is past president of the Association of Environmental and Resource Economists and a former chair of the Advisory Council for Clean Air Act Compliance Analysis. She has served on the advisory boards of Resources for the Future, the Harvard Center for Risk Analysis, the Donald Bren School of the Environment, and the AEI-Brookings Center on Regulation.

research strategy and the results of research conducted in accordance with this strategy. This mechanism could also allow EPA to obtain useful feedback from members of the research community on its economics research program.

Excerpt from Agency response from Administrator Michael O. Leavitt:

“I thank you, the Science Advisory Board, and Environmental Economics Advisory Committee for your review of the Environmental Economics Research Strategy. As

we work to ensure that EPA’s policies are founded on a solid underpinning of science, peer reviews like this are an important part of our efforts.

“Research developed in response to the EERS will be particularly important as we search for better ways to protect the environment. It will lead us to new and more effective environmental management approaches and will help ensure that the policies we adopt are both efficient and fair.”

Consultation on the Office of Research and Development’s Framework for Computational Toxicology, A Science Advisory Board Notification of a Consultation (EPA-SAB-CON-04-003)

In September 2003, the SAB Computational Toxicology Framework Panel provided a consultation on the Agency’s Draft Document, *A Framework for a Computational Toxicology Research Program in ORD*, for use by EPA’s Office of Research and Development (ORD) to implement a research program and to communicate the Agency’s research needs in the area of computational toxicology.

Genomics, combined with computational methods and bioinformatics, can be used to integrate modern computing and information technology with molecular biology and chemistry and help improve EPA’s prioritization of data requirements and risk assessments for toxic chemicals. EPA’s Office of Research and Development asked the panel to review the framework and provide advice on how such research should be prioritized.

Panel members found the *Framework* a useful tool for furthering EPA’s mission. “Omics” research could answer some key questions

about chemicals commonly encountered by risk assessors, as well as provide needed guidance on addressing unknown chemicals. Future frameworks should take into account integration of policy and science and provide a basis for the discussion of issues important to EPA programs and regions and provide a basis for involvement of stakeholders. Proposed next steps should include some common research protocols, test species, and chemicals that would fill immediate information needs in the current practice of risk assessment and would allow for some synergy and comparability between the many types of research conducted. The panel addressed specific questions concerning the likelihood of the research strategy to strengthen predictive models for hazard identification. The panel also explored means to enhance quantitative risk assessment, recommendations for additional issues to be captured in the *Framework*, priorities of research needs, applications of computational toxicology to address environmental problems, and measures to involve the larger scientific community and the public.

Agency response from Dr. Lawrence W. Reiter, Director, National Health and Environmental Effects Research Laboratory - Research Triangle Park, Office of Research and Development and Executive Lead for the Computational Toxicology Program:

“The consultation with the SAB on the *Framework*, which was held on September 12, 2003, represented a critical step in the evolution of the Computational Toxicology Program. For the first time, the strategy was presented to an external peer review group and reactions were sought. We were extremely pleased that the SAB felt that the *Framework* was a good effort on the part of a cross-section of scientists in the Office of Research and Development and that it should prove a useful tool for advancing our mission. We took their advice to better integrate with the policy arms of the Agency, to reach out in partnerships with public and private organizations in an effort to better leverage resources, to develop better links with other complementary research areas within our office, and to consider a number of specific steps to aid in the implementation of the program.

“The positive feedback from the SAB gave strong encouragement within the Office of Research and

Development to move forward with the Computational Toxicology Program. Last fall, we held a workshop that included representatives from the program offices and a number of external organizations to roll out the strategy to staff in our office, and we established a cross-Agency committee to oversee the translation of the *Framework* into a research program—the Computational Toxicology Implementation and Steering Committee. In FY 2004, we issued two internal requests for proposals to fund research in computational toxicology, and awarded nearly \$2.5 million to ten existing projects and seven new projects based on strategic directions laid out in the *Framework*. We also announced a call for proposals to establish a Center of Environmental Bioinformatics through our Science to Achieve Results Program and began working with the Office of Pesticide Programs to assist it in addressing re-registration needs for pesticidal inerts and non-food use antimicrobials—two large classes of chemicals with little supporting toxicological information. Ultimately, the Office of Research and Development made the decision to institutionalize the program by creating a National Center for

Steps in the SAB Life Cycle Process – Two Examples

Review of EPA's Draft Report on the Environment 2003 (EPA-SAB-05-004)

Requesting Offices: The Office of Research and Development (ORD) and Office of Environmental Information developed the *Draft Report on the Environment*, a report that seeks to address the status of and trends in environmental conditions and their impacts on human health and the nation's natural resources.

Background: The EPA asked the SAB for advice in five areas: the scientific analysis and presentation of information describing status and trends; assessment of the draft's use of indicators; measures of human health and ecological endpoints; the use of national and regional data; and the quality of the Public Report intended to summarize the Agency's technical documents. After considering 55 candidates recommended for their expertise in the following areas, the SAB formed a 20-member Panel to review EPA's *Draft Report on the Environment*.

Panel Expertise Required: Epidemiology of environmental pollutants ▪ Human exposure to environmental pollutants ▪ Human health risk assessment of environmental pollutants ▪ Natural resources management ▪ Whole ecosystems research ▪ Ecological risk assessment
▪ Ecosystems sustainability ▪ Environmental indicators
▪ Water resources management ▪ Land use management
▪ Waste management ▪ Emergency response and preparedness ▪ Air quality

Selection of Committee or Panel Type

The SAB Staff Office publishes a Federal Register notice to announce the establishment of an SAB Advisory Panel for each project and solicits nominations for panel membership.

Selection of Project

Proposed project requests are discussed at the SAB Executive Committee's Public Meeting as part of the Board's upcoming Fiscal Year Operating Plan.

Nomination of Project

The SAB Staff Office receives nominated advisory projects for SAB consideration from various EPA Offices, Program and Regional Offices, the Congress (through the Administrator), and the SAB.

Formation of Committee or Panel

The SAB Staff Office publishes a preliminary list, or "short list," of individuals selected for each project and announces its final selection of Panel members on the SAB Web site.

Advisory Meeting and Report Development

After introductory public conference call meetings, panelists meet in person to discuss a set of consensus points to be used in drafting the final project report.

Approval of Final Report

An SAB Quality Review Committee (QRC) reviews and approves the draft panel report during a public teleconference. Following this review, the chartered SAB reviews the QRC report and the draft panel report and approves the final report.

Transmittal of Report

The approved panel report is formatted and transmitted to the Administrator and posted on the SAB Web site.

Feedback and Evaluation

The SAB Staff Office seeks formal feedback from the Agency on the approved panel report and posts the Agency response on the SAB Web site.

EPA's Multimedia, Multipathway, and Multireceptor Risk Assessment (3MRA) Modeling System; A Review by the 3MRA Review Panel of the EPA Science Advisory Board (EPA-SAB-05-003)

Requesting Offices: The Office of Solid Waste (OSW) and the Office of Research and Development (ORD) developed the 3MRA system to evaluate wastes for exemption from Subtitle C of the Resource Conservation and Recovery Act (RCRA).

Background: The EPA asked the SAB to focus its review in the following four areas: assessment methodology, 3MRA modeling system, modeling system evaluation, and modeling system documentation. After considering 75 candidates recommended for their expertise in relevant areas, the SAB formed a 16-member Panel to review the complex modeling system and extensive documentation.

Panel Expertise Required: Integrated Software Technology for Multimedia Modeling ▪ Sensitivity and Uncertainty Analyses for Higher Order Environmental Models ▪ Quality Assurance and Model Evaluation
▪ Integrated Multimedia Fate and Transport Modeling–air focus ▪ Integrated Multimedia Fate and Transport Modeling–surface water focus ▪ Integrated Multimedia Fate and Transport Modeling–groundwater focus ▪ Integrated Multimedia Fate and Transport Modeling–food chain focus ▪ Integrated Modeling for Human and Ecological Risk Assessments ▪ National Probabilistic Risk Assessment using Monte Carlo-based Methods ▪ Properties of Chemicals and Environmental Media ▪ Nation-wide Risk Assessments ▪ Human toxicology ▪ Ecological toxicology ▪ Risk Communication ▪ Familiarity with hazardous waste regulations and remediation technologies



Dr. George W. Lucier
Chair: SAB Computational Toxicology Framework Panel

Dr. George W. Lucier is an environmental consultant with an emphasis on toxicology, exposure assessment, and risk assessment models that integrate diverse data sets. Dr. Lucier retired from the National Institute of Environmental Health Sciences in 2000

where he served as director of the Environmental Toxicology Program, associate director of the National Toxicology Program, and head of the research group on molecular toxicology and epidemiology. He also served as co-editor of the journal *Environmental Health Perspectives* and continues to serve as chair of the Scientific Advisory Board for the regulation of hazardous air pollutants in North Carolina. This board conducts risk assessments and recommends safe exposure levels of air pollutants. Dr. Lucier is a scientific advisor to the National Institutes of Environmental Health Sciences, National Toxicology Program, and World Health Organization and is the public health expert on the North Carolina-based Steering Committee for the development of environmentally superior technologies for handling hog waste. Dr. Lucier is a senior adjunct toxicologist with Environmental Defense.

Dr. Lucier received his Ph.D. from the University of Maryland School of Agriculture in 1965. During his career he has published more than 200 articles in peer-reviewed scientific literature and chaired dozens of scientific conferences and workshops, including working groups of the International Agency for Research on Cancer, workshops on biologically-based models for human risk assessments and exposure assessment, and conferences on herbal medicines and endocrine disrupters. He played a key role on numerous advisory boards and interagency activities including chairing a White House committee charged with reaching agreement among various agencies on risk assessments for methyl mercury. His research on mechanisms of action for dioxin, hormonally active chemicals, and risk assessment models is widely recognized and has led to several awards. Dr. Lucier led much of the effort to incorporate mechanistic studies into toxicological evaluations of the National Toxicology Program including the development and validation of alternative models. He also developed processes for National Toxicology Program review that were scientifically rigorous, open, and responsive to the concerns of various stakeholders.

Computational Toxicology, a step announced by the Assistant Administrator for the Office of Research and Development on November 3, 2004. The endorsement of the SAB was a pivotal step in moving the program from a conceptual state to one that is now advancing the science needed to help the Agency address increasingly more demanding prioritization steps and risk assessments through the use of the new tools of computational toxicology.”

Science Policy and Strategic Directions

The *Implementation Plan* for restructuring the SAB emphasized the importance of focusing on forward-looking advice on environmental progress, trends, priorities, innovative approaches to address environmental challenges, and the scientific and technical investments necessary to achieve greater and more cost-effective public health and environmental protection. Committees of the Board completed several projects in 2003-2004 that cut across EPA programs and strategic goals in these areas.

In addition, the SAB Staff Office formed the SAB Committee on Valuing the Protection of Ecological Systems and Services in August 2003. This committee is working to assess Agency needs; to provide advice on the science of valuing the protection of ecological systems and services, and to identify key areas for improving knowledge, methodologies, practice, and research. Two additional projects for future Board activity have also been considered, including a review of the overarching ecological risk assessment approach applied by EPA to diverse situations and an advisory project exploring science issues related to an integrated approach for reactive nitrogen.

Review of EPA’s Draft Supplemental Guidance for Assessing Cancer Susceptibility from Early-Life Exposure to Carcinogens, A Report by the Supplemental Guidance for Assessing Cancer Susceptibility Review Panel of the EPA Science Advisory Board (EPA-SAB-04-003)

In this review activity, the Agency sought the SAB’s evaluation of the soundness of the Agency’s analysis of the underlying scientific information supporting proposed guidance

for assessing cancer susceptibility from early-life exposures to carcinogens. The Board concurred with the Agency’s conclusions and the overall approach adopted by the Agency of using adjustment factors to account for increased susceptibility due to early-life exposure. The Board also agreed that the values chosen for the cancer slope adjustment factors in the *Supplemental Guidance* appear to be reasonable based on consideration of the literature; however, the Board suggested that the Agency improve the statistical analysis of the data and provide a more extensive discussion of the choice of the 10x and 3x adjustment factors. The Board also suggested that the Agency emphasize the use of default adjustment factors only when no chemical-specific data are available to directly assess cancer susceptibility from early-life exposure to a particular carcinogen. The Board also advised the Agency to consider conducting additional research to address this issue as discussed in the report.

Excerpt from Agency response from Administrator Michael O. Leavitt:

“The SAB Supplemental Guidance for Assessing Cancer Susceptibility Review Panel provided thoughtful, constructive comments that will

make a positive contribution to EPA’s analyses of early-life exposures to carcinogens. Based on the Panel’s recommendations, EPA is revising the Guidance and is implementing a number of suggestions that were highlighted ...”

Summary of specific revisions prepared by the Office of Research and Development and described in the Agency’s attachment to Administrator Leavitt’s response:

Based on panel recommendations, EPA is revising the Guidance and is implementing a number of suggestions. Agency implementation efforts include a more comprehensive search of the scientific literature to identify additional studies on early-life exposure to carcinogens, a more thorough discussion of data available on the effects of early-life exposures to carcinogens—with a particular emphasis on estrogenic agonists and antagonists—and a reevaluation of compiled data to include all tumor endpoints for chemicals previously included in the analysis. This additional research helps to create a more complete representation of the published literature on differential age sensitivity to chemical carcinogenesis. The Agency agreed that extending the analysis to estrogenic agents



Dr. Henry Anderson

Chair: SAB Supplemental Guidance for Assessing Cancer Susceptibility for Early-life Review Panel

Dr. Anderson holds positions as the state environmental and occupational disease epidemiologist in the Wisconsin Department of Health and Social Services, chief medical officer in the Wisconsin Division of Public

Health, and adjunct professor at the University of Wisconsin-Madison, Department of Population Health, and the University of Wisconsin Institute for Environmental Studies, Center for Human Studies. His expertise includes public health; preventive, environmental, and occupational medicine; respiratory diseases; epidemiology; human health risk assessment; and risk communication. Active research interests include: environmental health indicators and disease surveillance, childhood asthma, lead poisoning, reproductive and endocrine health hazards of sport fish consumption, arsenic in drinking water, chemical and nuclear terrorism, occupational and environmental respiratory disease, occupational fatalities, and occupational injuries to youth.

Dr. Anderson was a founding member of the Agency for Toxic Substances and Disease Registry Board of Scientific Councilors (1988-1992). He also served on National Academy of Sciences/Institute of Medicine committees that developed the reports *Injury in America* and *Nursing, Health & Environment*. He serves on the Presidential Advisory Board on Radiation Worker Compensation, the Hanford Human Health Effects Subcommittee, and the Rocky Flats Advisory Committee for the Beryllium Program. He serves on the Centers for Disease Control and Prevention (CDC) and the National Center for Environmental Health, Director's Advisory Committee. He is a fellow of the Collegium Ramazzini and the American Association for the Advancement of Science. He is associate editor of the *American Journal of Industrial Medicine* and serves on the editorial board of *Cancer Prevention International*.

Dr. Anderson received his M.D. degree in 1972 from the University of Wisconsin-Madison. He was certified in 1977 by the American Board of Preventive Medicine with a sub-specialty in occupational and environmental medicine and in 1983 became a fellow of the American College of Epidemiology.

and chemicals acting through other processes resulting in endocrine disruption is a reasonable priority in light of the human experience with diethylstilbestrol and the existing early-life animal studies. The Agency also noted plans to consider SAB suggestions regarding a feasible method in the future for incorporating transplacental or in-utero exposure data.

Review of EPA's Draft Report on the Environment 2003 (EPA-SAB-05-004)

The Board found that the Agency's Draft *Report on the Environment* is a critically important document, providing EPA's first national assessment of the environment in a context of human and ecological health. The SAB encouraged continued effort in developing and improving the draft *Report on the Environment* and expressed a belief that EPA is the appropriate agency to lead this effort. The SAB is committed to providing advice to EPA on a regular basis as the Agency develops future reports on the environment. The review recommended that such reports be produced on a regular basis and that EPA allocate necessary funds and staff to develop these documents. The SAB

recommended improvements in future reports to make those documents more useful to EPA and other intended audiences. The SAB also recommended that EPA keep future reports free of conclusions about the impacts of specific policies, except in cases where the policy is an obvious or undisputed explanation for a significant trend, and include indicator data relevant to global climate change.

Preliminary response from: Dr. Peter Preuss, Director, National Center for Environmental Assessment, Office of Research and Development :

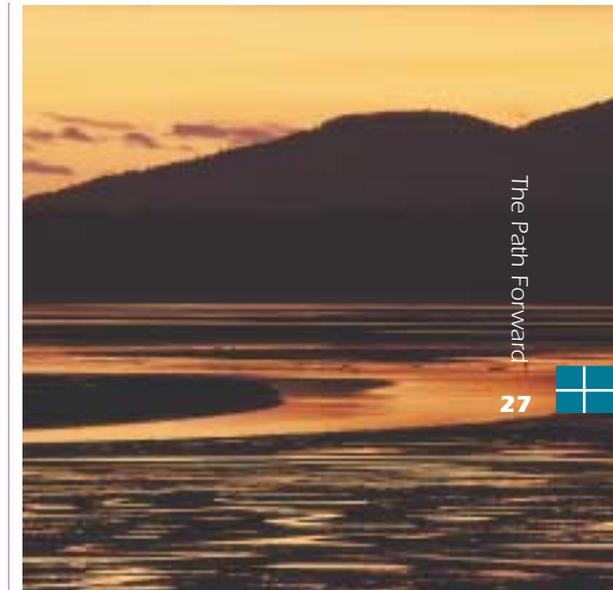
"The SAB review of EPA's Draft *Report on the Environment* will help to ensure a sound science foundation for the subsequent versions of these reports. The SAB's comments have led to establishment of

Dr. Virginia Dale

Chair: SAB Advisory Panel on EPA's Draft Report on the Environment

(Dr. Dale's biosketch appears on page 11, where her project as chair of the SAB's Ecological Processes and Effects Committee is described as a Goal 2 advisory activity.)

an explicit indicator definition and criteria; improved documentation of the data and science underlying indicators; revision of the questions that drive the report; a realignment of indicators and information across the report to improve the consistency across chapters; and specifically, a significant reorganization of the ecological condition chapter and indicators. Taken together, these steps will help to ensure that only the most relevant, objective, and transparent indicators based on the highest quality data will form the basis for the reports."





Working in New Ways

New Chairs for the CASAC and SAB

Consistent with the EPA SAB Staff Office policy on term limits for members and chairs of advisory committees, the EPA Administrator appointed new chairs for the CASAC and SAB in November 2004. Dr. Rogene Henderson is the new chair of the CASAC and Dr. M. Granger Morgan is the new chair of the SAB. These two scientists will work with their committees to provide the leadership necessary to provide support for Agency efforts.

The SAB Reorganization and the SAB Implementation Plan

In November 2003 EPA announced a reorganization of the Science Advisory Board. The



Implementation Plan that accompanied that announcement made clear that the Board retained its historic function to provide the EPA Administrator with outside, independent advice on the scientific and technical aspects of environmental issues. It also explained how the SAB Staff Office would form new *ad*

hoc committees on specific advisory topics, in addition to standing committees, to help the Board keep pace with complex environmental challenges facing the Agency. These committees would provide the Board with flexibility when addressing new topic areas. With this scheme in place, the Board established two *ad hoc* committees: the Committee on Valuing the Protection of Ecological Systems and Services, in August 2003, and a new Scientific and Technological Achievement Awards Review Panel for FY 2003-2005. Based on the *Implementation Plan*, SAB *de novo* review panels were also formed to address specific technical review issues. The SAB Staff Office announced the formation of seven *de novo* review panels on a wide range of topics and allowed for public comment during the nomination process for potential members.



Dr. Rogene Henderson

Chair: CASAC

Dr. Rogene Henderson is the director of the Lovelace Respiratory Symposium at the Lovelace Respiratory Research Institute. Dr. Henderson earned her Ph.D. in chemistry from the University of Texas in 1960 and her B.S./B.A. in chemistry from Texas Christian University in 1955. She was a Fulbright Scholar in physical chemistry in 1955-1956 and held fellowships at the Universities of Texas and Arkansas. Dr. Henderson's research interests are in three major areas: 1) biochemistry of the lung, particularly the surfactant lining layer—she has developed *in vivo* screening tests for pulmonary toxi-

cants based on analysis of bronchoalveolar washings for biomarkers of lung injury and repair; 2) the mechanisms by which pulmonary inflammation leads to repair or to chronic disease (fibrosis, emphysema); and 3) the pharmacokinetics of inhaled xenobiotics (particularly vapors) and chemical-specific biomarkers of chemical exposure. Dr. Henderson is currently a member of: the U.S. Army Deployment Toxicology Science Working Group; the Health Effects Institute Research Committee; the National Research Council/National Academy of Sciences' Board on Environmental Studies and Toxicology; and the American Cancer Society Advisory Group on Cancer and the Environment. Past advisory committee activities include: invited member of the January 1995 National Toxicology Program Workshop on "Mechanism-Based Toxicology in Cancer Risk Assessment: Implications for Research, Regulation, and Legislation;" member of the World Health Organization Advisory Group on Use of Biological Markers in Risk Assessment (1989, 1992); member of the *Ad Hoc* Advisory Group on Biologic Markers for EPA SAB, Environmental Health Committee (1989); member of the National Research Council Subcommittee on Guidelines for Estimating Acceptable Acute Exposures for Hazardous Substances (1990-1992), and member of the SAB Environmental Health Committee (1991-1995).



Dr. M Granger Morgan

Chair: SAB

Dr. M. Granger Morgan is university professor and head of the department of engineering and public policy at Carnegie Mellon University where he is also Lord chair professor in engineering, and is a professor in the department of electrical and computer engineering and in the H. John Heinz III School of Public Policy and Management. He holds a B.A. from Harvard College (1963) where he concentrated in physics, an M.S. in astronomy and space science from Cornell (1965), and a Ph.D. from the department of applied physics and information sciences at the University of California at San Diego (1969). Dr. Morgan's research addresses problems in science, technology, and public policy. Much of it has involved the development and demonstration of methods to characterize and treat uncertainty in quantitative policy analysis. He works on analysis, management and communication of risk, on problems in the integrated assessment of global change, on energy systems, focused particularly on electric power, on problems in technology and domestic security, on improving health, safety, and environmental regulation, and on several other topics in technology and public policy.

THE SAB REORGANIZATION... WILL FACILITATE THE BOARD-AND THE AGENCY-IN KEEPING UP WITH THE RAPID ADVANCEMENT OF SCIENCE AND TECHNOLOGY BY ENABLING THE BOARD TO FOCUS MORE OF ITS TIME AND ENERGIES ON EMERGING SCIENTIFIC ISSUES. IN ADDITION, IT WILL DO THIS WHILE CONTINUING TO ENSURE HIGH-QUALITY PEER REVIEW PROCESSES THAT FOLLOW THE HIGHEST STANDARDS.

The *Implementation Plan* also introduced a new mechanism for review of selected SAB reports. All draft reports prepared by SAB committees and panels are, by law, reviewed by the chartered SAB. To ensure that the SAB reports are of the highest quality, the *Implementation Plan* also requires that certain reports—drafts of original studies, significant reports created by *ad hoc* committees, and peer reviews of major Agency technical work products produced by panels—be reviewed through a new quality review mechanism. For example, the quality review process was used to review draft reports for two major initiatives in FY 2004, including reports of the 3MRA Modeling System Panel and the Advisory Panel on EPA's draft *Report on the Environment*.

In each case, a quality review committee was formed with the appropriate and relevant expertise for that particular quality review. The quality review committee held open public teleconferences to determine:

- whether the original charge questions to the panel were adequately addressed;



- whether there were any technical errors, omissions, or issues inadequately dealt with in the draft report;
- whether the draft report was clear and logical; and
- whether the conclusions drawn or recommendations provided were supported by the body of report.

SAB Workshops on Environmental Protection

The Board took action in 2003 and 2004 to reinvigorate its tradition of providing strategic and forward-looking advice to the Administrator on complex technical and emerging issues. The SAB Staff Office, working with the Board, held the first SAB Workshop on Environmental

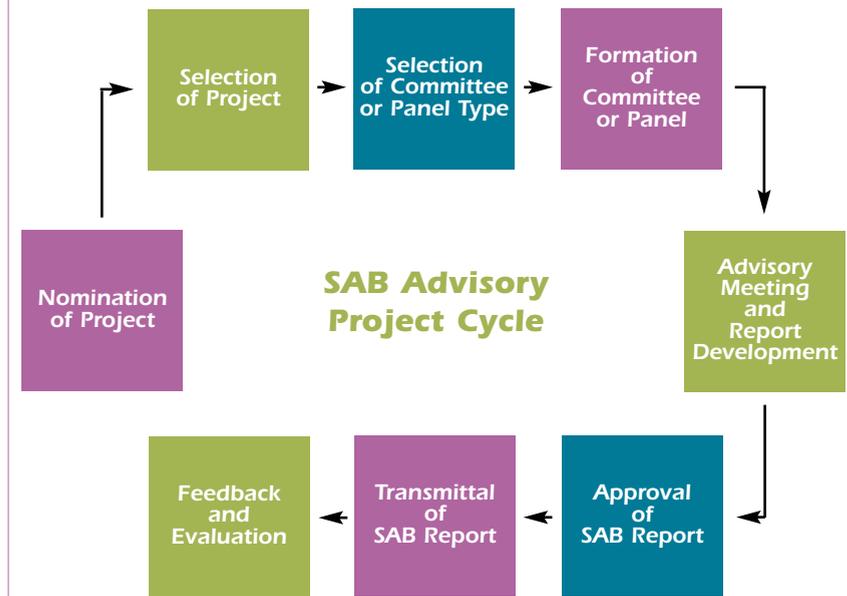
Protection on December 11, 2003. The workshop provided a forum for SAB members to interact with EPA and external scientific experts and to discuss several emerging areas important to EPA science and research programs. At the workshop, participants discussed air pollution, control of transboundary air pollutants, emerging contaminants, invasive species, nanotechnology, and genomics. The workshop focused on challenges and opportunities in environmental science for the Agency's mission to protect human health and the environment. Discussions focused on the underlying science in these areas and also touched on social, ethical, and legal implications. The workshop educated and informed the participants about these topics, with the goal of providing a basis for future SAB advice and recommendations to the Agency. The Board planned a workshop on "Nanotechnology, Biotechnology, and Information Technology Implications for Future Science" at EPA for December 2004 with a similar goal of advancing SAB thinking about these rapidly advancing fields.

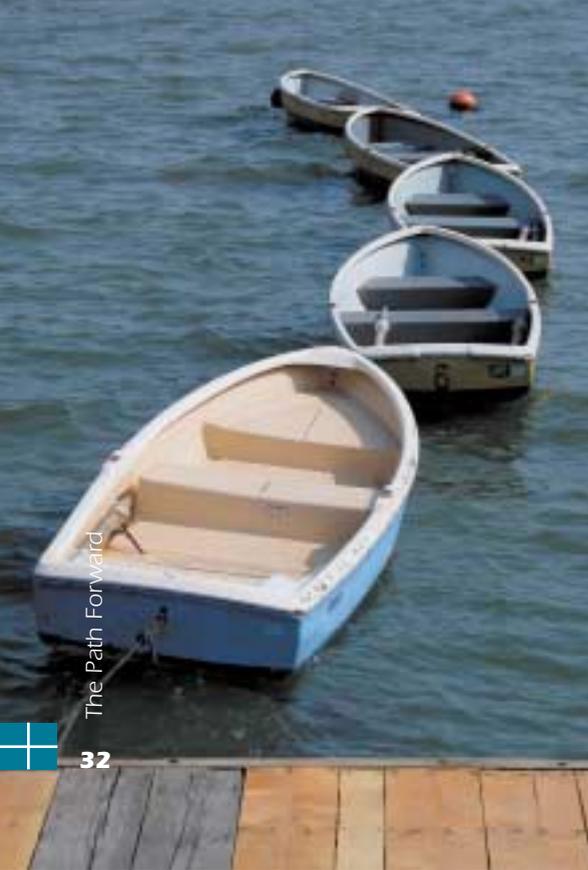
Continuing to Improve Support for Federal Advisory Committees

In FY 2003 and FY 2004, the SAB Staff Office worked to strengthen the infrastructure supporting the CASAC, Council, and SAB. In 2004, EPA provided a conference center designed for the advisory committees' work. The SAB Staff Office dedicated this space to the memory of a past chair (1997-2000) of the SAB Executive Committee, Dr. Joan Daisey, in recognition of her deep commitment to science advice of the highest quality, strong leadership, steadfast integrity, and joy in public service. The conference cen-

ter encompasses two conference rooms and a reception space to provide a secure, comfortable, and well-equipped venue for public meetings of the advisory committees.

The Staff Office has devoted much of the past two years to strengthening science advice by improving each step in the life cycle of science advisory projects. The multiple steps in the life cycle of advisory projects are detailed in the *SAB Implementation Plan*. Much of the work of the SAB Staff Office involves working with Agency leadership and the leadership of the CASAC, the Council, and the Board on the development of projects, the formation of panels to provide





advice related to those projects. The Staff Office also helps manage advisory meetings during the report development process. By law and in practice, many of the steps entail public involvement. Improving the effectiveness of public involvement in advisory committee activities has been a high priority.

In the area of panel formation and selection of members for the CASAC, Council, and SAB, the Board has received independent recognition for the improvements

introduced in FY 2002 and continued in FY 2003 and FY 2004. Major recognition came from the U.S. Office of Government Ethics (OGE), which completed a program review of EPA's ethics program in February 2004. As part of that program review, OGE reviewed the financial disclosure records and procedures of the Science Advisory Board. In its report, OGE complimented EPA's work to improve compliance and training at EPA. In particular, OGE stated that the "development of an alternative, confidential financial disclosure system and an improved ethics training program for special Government Employee (SGE) members of EPA's Federal advisory committees appear to have corrected previously identified deficiencies in this program element." As a result of this program review, EPA was presented with the Outstanding Ethics Program Award at the 2003 OGE Conference in New York.

The General Accounting Office's (GAO) report, *Federal Advisory Committees; Additional Guidance Could Help Agencies Better Ensure Independence and Balance* (GAO-04-328), includes a section devoted to the best practices that might be adopted throughout the federal government to better ensure independence and balance. In this section,

the GAO noted that the SAB uses its Web site to solicit nominations from the public for panel membership. The report also commends the National Academies of Sciences and the Science Advisory Board for procedures that clearly and consistently identify the information they deem necessary to assess candidates for independence and balance on the committees, explain to the candidates why the required information is important to protect the integrity of the committee's work, request public comment on proposed committee membership, and require evaluation of the overall balance of committees before they are finalized. The National Academies of Sciences also noted in the report *Science and Technology in the National Interest; Ensuring the Best Presidential and Federal Advisory Committee Science and Technology Appointments* (2005) that the SAB Staff Office had introduced a suite of best practices that provide models for other federal agencies to follow.

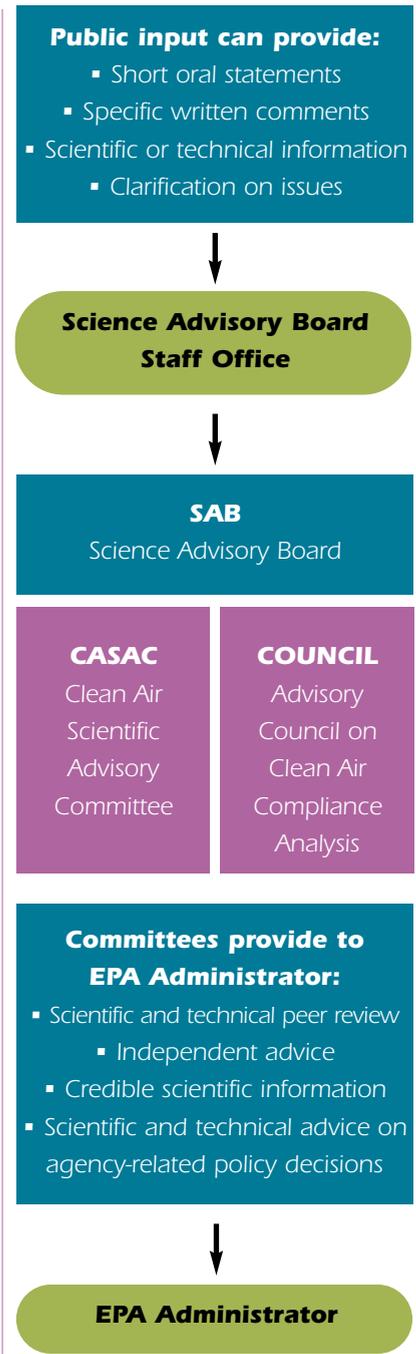
In FY 2003 and FY 2004, the SAB Staff Office also implemented a formal process for reaching out to professional societies to seek nominations for membership to its advisory committees in the interest of bringing new expertise, energy, and perspectives to EPA. Nominees rec-

ommended by two professional societies were appointed by the Administrator and now serve on SAB committees.



Finally, the Staff Office continued efforts to inform the public about the work of the CASAC, Council, and SAB and to

involve the public, as appropriate, in advisory committee work. The Staff Office has published a brochure entitled *Advisory Committee Meetings and Report Development: Process for Public Involvement; A Report of the Science Advisory Board Staff Office* (EPA-SABSO-04-001). The Staff Office held public meetings to discuss the planned SAB reorganization and has also included a wide spectrum of individuals, both from within and outside the Agency, in focus groups to provide insights on the redesign of the SAB Web site.





Goals for FY 2005 and FY 2006

In the upcoming fiscal years, the Staff Office foresees a portfolio of projects that reflect high-priority peer reviews; consultations and advisory reports on emerging science needs for the Agency; continued refinement of the process for providing advice for the Agency's strategic investments in science and research; and the results of several important self-initiated projects, including the work of the SAB Committee on Valuing the Protection of Ecological Systems and Services. The Staff Office also envisions formation of a new *ad hoc* committee addressing homeland security science issues. The Staff Office will also seek opportunities to provide advice to the Agency in partnership with other federal advisory committees at EPA.

Improving the infrastructure for the SAB is a continuing goal. It will be a priority to develop administrative procedures that make the best use of information technology and Agency's resources and ease the paperwork burden on committee and panel members. The vision for the SAB Web site is for an attractive, easy-to-use site that delivers up-to-date, consistent, and integrated information about advisory activities and products.

The SAB, established by Congress in 1978, has now entered its second quarter century better equipped to address the science issues posed by environmental protection challenges. There is an increasing emphasis in its work and in the work of the CASAC and Council on providing a strategic

approach to science advice. This strategic approach aims to deliver advice that is multi-disciplinary, that engages the Agency early in the development of projects, and that looks toward the environmental solutions necessary in the twenty-first century. This dedicated focus on strategic advice and the insistence on quality peer review of Agency science point to a successful path forward for the next two years and beyond.

Appendices

Appendix 1: Chartered Federal Advisory Committees Supported by the SAB Staff Office

CLEAN AIR SCIENTIFIC ADVISORY COMMITTEE (CASAC)

Provides independent advice to the EPA administrator on the technical bases for EPA's national ambient air quality standards program.

The CASAC was established in 1977 under the Clean Air Act (CAA) Amendments of 1977 (see 42 U.S.C. § 7409(d)(2)) to provide advice, information and recommendations to the Administrator on the scientific and technical aspects of issues related to the criteria for air quality standards, research related to air quality, sources of air pollution, and the strategies to attain and maintain air quality standards and to prevent significant deterioration of air quality.

The CASAC has one standing subcommittee: the Ambient Air Monitoring and Methods Subcommittee.

Membership as of November 2004:

CHAIR: Dr. Rogene Henderson, Scientist Emeritus, Lovelace Respiratory Research Institute, Albuquerque, NM

PAST CHAIR: Dr. Philip Hopke, Bayard D. Clarkson Distinguished Professor, Department of Chemical Engineering, Clarkson University, Potsdam, NY

MEMBERS:

Dr. Ellis B. Cowling, University Distinguished Professor At-Large, Colleges of Natural Resources and Agriculture and Life Sciences, North Carolina State University, Raleigh, NC

Dr. James Crapo, Executive Vice President for Academic Affairs and Chairman, Department of Medicine, National Jewish Hospital and Medical Research Center, Denver, CO

Dr. Frederick J. Miller, Vice President for Research, Centers for Health Research, Chemical Industry Institute of Toxicology, Research Triangle Park, NC

Mr. Richard L. Poirot, Environmental Analyst, Air Pollution Control Division, Department of Environmental Conservation, Vermont Agency of Natural Resources, Waterbury, VT

Dr. Frank Speizer, Edward Kass Professor of Medicine, Channing Laboratory, Harvard Medical School, Boston, MA

Dr. Barbara Zielinska, Research Professor, Division of Atmospheric Sciences, Desert Research Institute, Reno, NV

Acknowledgment of Members Who Completed Membership Terms in FY 2004

Dr. Philip Hopke, for valued service as member and chair of CASAC

Acknowledgment of Members Who Completed Membership Terms in FY 2003

Dr. George E. Taylor, for valued service on CASAC

Dr. Sverre Vedal, for valued service on CASAC

ADVISORY COUNCIL ON CLEAN AIR COMPLIANCE ANALYSIS (COUNCIL)

The Council was established in 1990 pursuant to the CAA Amendments of 1990 (see 42 U.S.C. §7612) to provide advice, information and recommendations on technical and economic aspects of analyses and reports EPA prepares concerning the impacts of the CAA on the public health, economy, and environment of the United States.

The Clean Air Act Amendments of November 15, 1990 require the Council to:

- Review data to be used for any analysis required under section 312 of the CAA and make recommendations on its use.
- Review the methodology used to analyze such data and make recommendations on the use of such methodology.
- Prior to the issuance of a report to Congress required under section 312 of the CAA, review the findings of the report and make recommendations concerning the validity and utility of such findings.

The Council has three Standing Subcommittees: the Air Quality Modeling Subcommittee, Ecological Effects Subcommittee, and Health Effects Subcommittee.

Membership as of November 2004:

CHAIR: Dr. Trudy Ann Cameron, Raymond F. Mikesell Professor of Environmental and Resource Economics, Department of Economics, University of Oregon, Eugene, OR

MEMBERS:

Dr. David T. Allen, The Gertz Regents Professor in Chemical Engineering, Department of Chemical Engineering, University of Texas, Austin, TX

Dr. Dallas Burtraw, Senior Fellow, Resources for the Future, Washington, DC

Ms. Lauraine Chestnut, Managing Economist, Stratus Consulting Inc., Boulder, CO

Dr. Charles T. Driscoll, Jr., Distinguished Professor and Chair, Department of Civil and Environmental Engineering, College of Engineering and Computer Science, Syracuse University, Syracuse, NY

Dr. Wayne Gray, Professor, Department of Economics, Clark University, Worcester, MA

Dr. James K. Hammitt, Professor of Economics and Decision Sciences, Center for Risk Analysis, School of

Public Health, Harvard University, Boston, MA

Dr. F. Reed Johnson, Principal Economist and RTI Fellow, RTI Health Solutions, Research Triangle Institute, Research Triangle Park, NC

Dr. Katherine Kiel, Associate Professor, Department of Economics, College of the Holy Cross, Worcester, MA

Dr. Nino Kuenzli, Professor, Department of Preventive Medicine, Keck School of Medicine, University of Southern California, Los Angeles, CA

Dr. Virginia McConnell, Senior Fellow and Professor of Economics, Resources for the Future, Washington, DC

Dr. Bart Ostro, Chief, Air Pollution Epidemiology Unit, California Office of Environmental Health Hazard Assessment, Oakland, CA

Dr. V. Kerry Smith, University Distinguished Professor, Department of Agricultural and Resource Economics, College of Agriculture and Life Sciences, North Carolina State University, Raleigh, NC

Dr. Chris Walcek, Senior Research Scientist, Atmospheric Sciences Research Center, State University of New York, Albany, NY

Acknowledgment of Members Who Completed Membership Terms in FY 2004:

Dr. Charles Kolstad, for valued service on the Council

Dr. Lester Lave, for valued service on the Council

Acknowledgment of Members Who Completed Membership Terms in FY 2003

Dr. Lawrence Goulder, for valued service on the Council

Science Advisory Board (SAB)

Provides independent advice to the EPA Administrator on broad scientific and technical matters in science, technology, social, and economic issues that underlie EPA regulations, environmental policies and programs, and the supporting science and research programs.

The SAB was established in 1978 under the Environmental Research, Development, and Demonstration Authorization Act (ERDDAA) [42 U.S.C. § 4365] to provide independent advice and peer review on the scientific and technical aspects of environmental problems and issues as requested by the Administrator, or by the Congress through the Administrator. Most (though not all) preliminary work of the SAB is done by Subcommittees or Panels focused on various environmental science topics. These groups are chaired by Board members. Recommendations of Subcommittees and Panels are

transmitted to the Board for discussion and deliberation. Recommendations are forwarded to EPA only if the Board determines that it is appropriate.

The SAB has seven standing committees: Drinking Water Committee, Ecological Processes and Effects Committee, Environmental Economics Advisory Committee, Environmental Engineering Committee, Environmental Health Committee, Integrated Human Exposure Committee, and Radiation Advisory Committee. The SAB has two *ad hoc* committees: Committee on Valuing the Protection of Ecological Systems and Services and the Scientific and Technical Achievement Awards Advisory Committee.

Membership as of November 2004

CHAIR: Dr. M. Granger Morgan, Professor and Head, Department of Engineering and Public Policy, Carnegie Mellon University, Pittsburgh, PA

PAST CHAIR: Dr. William H. Glaze, Professor, Department of Environmental & Biomolecular Systems, OGI School of Science & Engineering, Oregon Health & Science University, Beaverton, OR

VICE CHAIR: Dr. Domenico Grasso, Rosemary Bradford Hewlett Professor and Chair, Picker Engineering Program, Smith College, Northampton, MA

MEMBERS

Dr. Gregory Biddinger, Environmental Programs Coordinator, ExxonMobil Biomedical Sciences, Inc, Houston, TX

Dr. James Bus, Director of External Technology, Toxicology and Environmental Research and Consulting, The Dow Chemical Company, Midland, MI

Dr. Trudy Ann Cameron, Raymond F. Mikesell Professor of Environmental and Resource Economics, Department of Economics, University of Oregon, Eugene, OR

Dr. Deborah Cory-Slechta, Director, Environmental and Occupational Health Sciences Institute, Robert Wood Johnson Medical School, University of Medicine and Dentistry of New Jersey and Rutgers State University, Piscataway, NJ

Dr. Maureen L. Cropper, Professor, Department of Economics, University of Maryland, College Park, MD

Dr. Virginia Dale, Corporate Fellow, Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN

Dr. Kenneth Dickson, Professor, Department of Biological Sciences, University of North Texas, Denton, TX

Dr. Baruch Fischhoff, Howard Heinz University Professor, Department of Social and Decision Sciences, Department of Engineering and Public Policy, Carnegie Mellon University, Pittsburgh, PA

Dr. A. Myrick Freeman, Research Professor of Economics, Department of Economics, Bowdoin College, Brunswick, ME

Dr. James Galloway, Professor of Environmental Sciences, Environmental Sciences Department, University of Virginia, Charlottesville, VA

Dr. Lawrence Goulder, Shuzo Nishihara Professor of Environmental and Resource Economics, Department of Economics and Institute for International Studies, Stanford University, Stanford, CA

Dr. Linda Greer, Senior Scientist, Natural Resources Defense Council, Washington, DC

Dr. Rogene Henderson, Scientist Emeritus, Lovelace Respiratory Research Institute, Albuquerque, NM

Dr. Philip Hopke, Bayard D. Clarkson Distinguished Professor, Department of Chemical Engineering, Clarkson University, Potsdam, NY

Dr. James H. Johnson, Dean, College of Engineering, Architecture & Computer Sciences, Howard University, Washington, DC

Dr. Meryl Karol, Associate Dean for Academic Affairs, Graduate School of Public Health, University of Pittsburgh, Pittsburgh, PA

Dr. Roger E. Kasperson, Professor, George Perkins Marsh Institute, Clark University, Worcester, MA

Dr. Catherine Kling, Professor, Department of Economics, Iowa State University, Ames, IA

Dr. George Lambert, Associate Professor and Center Director, Center for Child and Reproductive Environmental Health, Environmental and Occupational Health Sciences Institute, Robert Wood Johnson Medical School/ University of Medicine and Dentistry of New Jersey, Piscataway, NJ

Dr. Jill Lipoti, Assistant Director, Division of Environmental Safety and Health, Radiation Protection and Release Prevention Element, Radiation Protection Programs, New Jersey Department of Environmental Protection, Trenton, NJ

Dr. Genevieve Matanoski, Professor, Department of Epidemiology, Johns Hopkins University, Baltimore, MD

Dr. Michael J. McFarland, Associate Professor, Department of Civil and Environmental Engineering, Utah State University, River Heights, UT

Dr. Rebecca Parkin, Associate Professor, Environmental and Occupational Health, Public Health and Health Services, The George Washington University, Washington, DC

Dr. David Rejeski, Foresight and Governance Project Director, Woodrow Wilson International Center for Scholars, Washington, DC

Dr. Joan B. Rose, Professor, Homer Nowlin Chair in Water Research, Department of Fisheries and

Wildlife, Michigan State University, E. Lansing, MI

Dr. Kristin Shrader-Frechette, O'Neill, Professor of Philosophy and Professor of Biological Sciences, Department of Philosophy, College of Arts and Sciences, University of Notre Dame, Notre Dame, IN

Dr. Robert Stavins, Albert Pratt Professor of Business and Government, Environment and Natural Resources Program, John F. Kennedy School of Government, Harvard University, Cambridge, MA

Dr. Deborah Swackhamer, Professor, Division of Environmental and Occupational Health, School of Public Health, University of Minnesota, Minneapolis, MN

Dr. Thomas L. Theis, Professor, Civil and Materials Engineering, Director, Institute for Environmental Science and Policy, University of Illinois at Chicago, Chicago, IL

Dr. R. Rhodes Trussell, President, Trussell Technologies, Inc., Pasadena, CA

Dr. Robert Twiss, Professor, The Graduate School, University of California-Berkeley, Ross, CA

Dr. Terry F. Young, Consultant, Environmental Defense, Oakland, CA

Dr. Lauren Zeise, Chief, Reproductive and Cancer Hazard Assessment Section, California Environmental Protection Agency, Oakland, CA

Acknowledgment of Members Who Completed Membership Terms in FY 2004

Dr. Dallas Burtraw, for valued service on the SAB Environmental Economics Advisory Committee

Dr. Kenneth Cummins, for valued service on the SAB

Dr. Mary Davis, for valued service on the SAB Drinking Water Committee

Dr. William H. Glaze, for valued service as chair and member of the SAB

Dr. Annette Guiseppe Elie, for valued service on the SAB Integrated Human Exposure Committee

Dr. Philip Hopke, for valued service on the SAB

Dr. Thomas Louis, for valued service on the SAB Drinking Water Committee

Dr. Charles Pittinger, for valued service on the SAB Environmental Processes and Effects Committee

Dr. Hilary Sigman, for valued service on the SAB Environmental Economics Advisory Committee

Dr. William H. Smith, for valued service on the SAB

Dr. R. Rhodes Trussell, for valued service on the SAB and as member and chair of the SAB Drinking Water Committee

Dr. David Wallinga, for valued service on the SAB's Integrated Human Exposure Committee

Acknowledgment of Members Who Completed Membership Terms in FY 2003

Dr. Henry Anderson, for valued service on the SAB and as chair and member of SAB's Environmental Health Committee

Dr. Steven Bartell for valued service on SAB's Research Strategies Advisory Committee

Dr. Robin Cantor for valued service on SAB's Research Strategies Advisory Committee

Dr. David Hoel, for valued service on SAB's Environmental Health Committee

Dr. Janet A. Johnson, for valued service on the SAB and as chair and member of the Radiation Advisory Committee

Dr. Raymond C. Loehr, for valued service on the SAB

Dr. Bruce Rittmann, for valued service on SAB's Environmental Engineering Committee

Dr. Genevieve Roessler, for valued service on SAB's Radiation Advisory Committee

Dr. Ken Sexton, for valued service on SAB's Integrated Human Exposure Committee

Dr. Gary Toranzos, for valued service on SAB's Drinking Water Committee

Dr. Mark Utell, for valued service on SAB's Research Strategies Advisory Committee

Dr. James Watson, for valued service on SAB's Research Strategies Advisory Committee

Appendix 2: Completed Advisory Reports for FY 2003 and FY 2004 By Type of Key Science Advice Goal and Advisory Committee or Panel

Goal 1: Clean Air

Advisory Committee or Panel	Report Name and Citation
CASAC Ambient Air Monitoring and Methods Subcommittee	Clean Air Scientific Advisory Committee (CASAC) Ambient Air Monitoring and Methods (AAMM) Subcommittee Consultation on Methods for Measuring Coarse-Fraction Particulate Matter (PM _c) in Ambient Air (July 2004) (EPA-SAB-CASAC-CON-04-005)
CASAC National Ambient Air Monitoring Strategy Subcommittee	Clean Air Scientific Advisory Committee Review of the Agency's National Ambient Air Monitoring Strategy (EPA-SAB-CASAC-LTR-04-001)
CASAC Ozone Review Panel	Consultation on the Agency's Project Work Plan for Revised Air Quality Criteria for Ozone and Related Photochemical Oxidants (EPA-SAB-CASAC-CON-03-004)
CASAC Particulate Matter Review Panel	<p>Consultation on the Agency's Risk Analysis Plans for Coarse Particulate Matter (PM_{10-2.5} and PM₁₀) (EPA-SAB-CASAC-CON-03-005)</p> <p>Clean Air Scientific Advisory Committee (CASAC) Particulate Matter (PM) Review Panel's Review of the Agency's Fourth External Review Draft of Air Quality Criteria for Particulate Matter (June 2003) (EPA-SAB-CASAC-LTR-04-002)</p> <p>Clean Air Scientific Advisory Committee (CASAC) Particulate Matter (PM) Review Panel's Ongoing Peer Review of the Agency's Fourth External Review Draft of Air Quality Criteria for Particulate Matter (June 2003); and Peer Review of the Review of the National Ambient Air Quality Standards for Particulate Matter: Policy Assessment of Scientific and Technical Information (OAQPS Staff Paper - First Draft) (August 2003) and a Related Draft Technical Report, Particulate Matter Health Risk Assessment for Selected Urban Areas (Draft Report) (August 2003) (EPA-SAB-CASAC-04-004)</p> <p>Clean Air Scientific Advisory Committee (CASAC) Particulate Matter (PM) Review Panel's Ongoing Peer Review of the Agency's Fourth External Review Draft of Air Quality Criteria for Particulate Matter (June 2003) (EPA-SAB-CASAC-04-005)</p> <p>Clean Air Scientific Advisory Committee (CASAC) Particulate Matter (PM) Review Panel's Ongoing Peer Review of the Agency's Fourth External Review Draft of Air Quality Criteria for Particulate Matter (June 2003) (EPA-SAB-CASAC-04-008)</p>

Advisory Committee or Panel	Report Name and Citation
	EPA's Fourth External Review Draft of Air Quality Criteria for Particulate Matter, A Peer Review by the Clean Air Scientific Advisory Committee Particulate Matter Review Panel (EPA-SAB-CASAC-05-001)
Advisory Council on Clean Air Compliance Analysis	Review of the Draft Analytical Plan for EPA's Second Prospective Analysis—Benefits and Costs of the Clean Air Act, 1990-2020: An Advisory by the Advisory Council for Clean Air Compliance Analysis (EPA-SAB-COUNCIL-ADV-04-004)
Council Air Quality Modeling Subcommittee	Advisory on Plans for Emissions Estimation in the Analytical Plan for EPA's Second Prospective Analysis—Benefits and Costs of the Clean Air Act, 1990-2020; An Advisory by the Advisory Council for Clean Air Compliance Analysis (EPA-SAB-COUNCIL-ADV-04-001)
Council Health Effects Subcommittee	Advisory on Plans for Health Effects Analysis in the Analytical Plan for EPA's Second Prospective Analysis—Benefits and Costs of the Clean Air Act, 1990-2020; Advisory by the Health Effects Subcommittee of the Advisory Council on Clean Air Compliance Analysis (EPA-SAB-COUNCIL-ADV-4-002)
SAB Multi-Agency Radiological Laboratory Analytical Protocols Review Panel	Multi-Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual: An SAB Review (EPA-SAB-RAC-03-009)
SAB Radiation Advisory Committee	<p>Multi-Agency Radiation Site Survey Investigation Manual (MARSSIM) Supplements for Materials & Equipment (MARSAME): A Science Advisory Board Notification of a Consultation (EPA-SAB-RAC-CON-03-002)</p> <p>Multi-Agency Radiation Site Survey Investigation Manual (MARSSIM) Supplement for Sub-Surface Soils (MARSAS): A Science Advisory Board Notification of a Consultation (EPA-SAB-RAC-CON-03-003)</p> <p>Second Consultation on Multi-Agency Radiation Site Survey Investigation Manual (MARSSIM) Supplements for Materials & Equipment (MARSAME): A Science Advisory Board Notification of a Consultation (EPA-SAB-RAC-CON-04-001)</p>

Goal 2: Clean and Safe Water

Advisory Committee or Panel	Report Name and Citation
SAB Drinking Water Committee Stage 2 Disinfection/Disinfectant By Product Rule Panel	Disinfection Byproducts and Surface Water Treatment: An EPA Science Advisory Board Review of Certain Elements of the Stage 2 Regulatory Proposals (EPA-SAB-DWC-03-005)
SAB Ecological Processes and Effects Committee Panel on Suspended and Bedded Sediments	EPA's Strategy on Suspended and Bedded Sediments: An EPA Science Advisory Board Notification of a Consultation (EPA-SAB-EPEC-CON-04-002)

Goal 3: Land Preservation and Restoration

Advisory Committee or Panel	Report Name and Citation
SAB Environmental Engineering Committee	Improving Leach Testing of Waste: An EPA Science Advisory Board Notification of a Consultation (EPA-SAB-EEC-CON-03-006)
SAB Multimedia Multipathway Multireceptor Risk Assessment (3MRA) Modeling System Panel	EPA's Multimedia, Multipathway, and Multireceptor Risk Assessment (3MRA) Modeling System; A Review by the 3MRA Review Panel of the EPA Science Advisory Board (EPA-SAB-05-003)

Advice Related to Science Planning

Advisory Committee or Panel	Report Name and Citation
Science Advisory Board	Review of the FY2004 Science and Technology Budget Request for the U.S. Environmental Protection Agency: An EPA Science Advisory Board Review (EPA-SAB-EC-03-006)
Science Advisory Board	Advisory Report on the Science and Research Budgets for the U.S. Environmental Protection Agency for Fiscal Year 2005; A Report by the EPA Science Advisory Board (EPA-SAB-ADV-04-003)
SAB Air Toxics Research Strategy and Multi-Year Plan Panel	EPA's Air Toxics Research Strategy Air Toxics Multi-Year Plan, A Review by the Air Toxics Research Strategy and Multi-Year Plan Panel of the EPA Science Advisory Board (EPA-SAB-05-002)

Advisory Committee or Panel	Report Name and Citation
SAB Advisory Panel on the Environmental Economics Research Strategy	Review of the Environmental Economics Research Strategy of the U.S. Environmental Protection Agency; A Report by the EPA Science Advisory Board Environmental Economics Advisory Committee (EPA-SAB-04-007)
SAB Computational Toxicology Framework Consultative Panel	Consultation on the Office of Research and Development's Framework for Computational Toxicology, A Science Advisory Board Notification of a Consultation (EPA-SAB-CON-04-003)
SAB Contaminated Sediments Science Plan	Contaminated Sediments Science Plan: A SAB Report (EPA-SAB-EC-03-008)
SAB Environmental Engineering Committee	Contaminated Sites Multi-Year Plan: An SAB Report (Report in final production)
SAB Human Health Research Strategy Review Panel	Review of the Draft Human Health Research Strategy for Improving Risk Assessment: A Report of the USEPA Science Advisory Board (EPA-SAB-EC-03-010)

Advice Related to Cross-Goal Strategies: Science Policy and Strategic Directions

Advisory Committee or Panel	Report Name and Citation
Science Advisory Board	Data Quality and Reproducibility: An EPA Science Advisory Board Notification of a Consultation (EPA-SAB-EC-CON-03-001)
SAB Advisory Panel on EPA's Report on the Environment	Review of EPA's Draft Report on the Environment 2003 (EPA-SAB-05-004)
SAB Environmental Economics Advisory Committee	The Valuation of Mortality Risk Reduction: A Science Advisory Board Notification of a Consultation (EPA-SAB-CON-04-004)
SAB Scientific and Technological Achievement Awards Subcommittee	Recommendations on the FY2001 Scientific and Technological Achievement Award (STAA) Nominations: An SAB Report (EPA-SAB-EC-03-003)
SAB Scientific and Technological Achievement Awards Review Panel FY2003-2005	Recommendations on the FY2003 Scientific and Technological Achievement Awards (STAA) Nominations, A Report by the Scientific and Technological Achievement Awards Panel of the EPA Science Advisory Board (EPA-SAB-04-006)
SAB Supplemental Guidance for Assessing Cancer Susceptibility for Early-life Review Panel	Review of EPA's Draft Supplemental Guidance for Assessing Cancer Susceptibility from Early-Life Exposure to Carcinogens, A Report by the Supplemental Guidance for Assessing Cancer Susceptibility Review Panel of the EPA Science Advisory Board (EPA-SAB-04-003)