United States
Environmental Protection
Agency

Science Advisory Board
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EPA

Report of the Director of the Science Advisory Board for Fiscal Year 1986

UNITED STATES · ENVIRONMENTAL PROTECTION AGENCY

SCIENCE ADVISORY BOARD

This report has been written as a part of the activities of the Science Advisory Board, a public advisory group providing extramural scientific information and advice to the Administrator and other officials of the Environmental Protection Agency. The Board is structured to provide a balanced expert assessment of scientific matters related to problems facing the Agency. This report has not been reviewed for approval by the Agency, and hence the contents of this report do not necessarily represent the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

FORWARD

The task of improving the research programs and the scientific bases of the regulatory decisions of the Environmental Protection Agency is one of the most important challenges facing the Agency. During the fiscal year just completed the Administrator's Science Advisory Board performed an increasingly active and important role in conducting independent reviews of the quality of EPA's scientific work. Such reviews have constituted a major avenue for the scientific community to participate in EPA's decision making process. They have also enhanced the development of a more extensive dialogue and a better understanding between scientists and regulators in their mutual quest to resolve the environmental problems facing the nation.

It is my hope that this first annual report of the Director of the Science Advisory Board will lead to a greater public understanding not only of the Board's role and responsibilities, but also of ongoing efforts for developing scientific consensus as a basis for environmental problem solving.

Terry F. Yosie, Director
Science Advisory Board

TABLE OF CONTENTS

I. Overview of Fiscal Year 1986 Science Advisory Board Activities

This is the first in what is intended to be a series of Science Advisory Board (SAB) annual reports. Its primary purpose is to better inform the Environmental Protection Agency, SAB members and consultants, and the community of individuals and organizations that are interested in the Board, of its continuing activities. This report also represents an effort to promote a better understanding among these audiences (and the broader scientific community) of the Board's role in EPA decision making, and its efforts to provide constructive scientific advice.

Given the significant role that the Agency performs in American society, there is a critical need to ensure that EPA uses improved scientific data and that its judgments about such data are appropriate. Scientific data form the foundation of most of EPA's regulatory and other programs under the authorizing statutes that it implements.

During Fiscal Year 1986 (FY '86) the Science Advisory Board conducted independent scientific reviews in all of the EPA's major research and regulatory program areas. On some occasions the Board generally endorsed the scientific logic, methods and conclusions used by EPA's research and regulatory offices. At other times, it has criticized the Agency's scientific work. In either case, the Board attempted to identify areas where the scientific basis for decision making can be improved. The Board concludes that the scientific dialogue between its members and consultants and EPA staff has been constructive, and should lead to greater public confidence in the activities of the EPA.

FY '86 represented the most active year in the history of the Science Advisory Board (SAB). A variety of indicators support this conclusion, including the number of scientific issues reviewed by or requested of the Board, the number of final technical reports submitted to the Agency, the number of new Board members and consultants participating in scientific reviews, and expanded resources made available to carry out these and other activities.

The Board conducted a number of different kinds of scientific reviews in FY '86. These included reviews of individual research programs and, for the first time, an evaluation of the President's proposed budget for the Office of Research and Development (for FY '87); the technical basis of regulations or standards; Agency policy statements or guidance; reviews of scientific methodologies; non-research program reviews; EPA advisory documents; specific scientific proposals, studies or surveys; letter reports to EPA or Congress; and scientific reviews conducted for other Federal agencies.

During the past three years several trends have emerged in EPA's use of the Science Advisory Board. These trends point to a greater understanding of the respective roles and responsibilities by EPA staff, and scientists and engineers that serve on the Board. They also testify to the utility of consulting with the scientific community to strengthen the scientific basis of EPA decisions and identify needed research to support ongoing EPA programs. These trends include:

- Expanded number of scientific reviews. The number of scientific reviews conducted by SAB has risen from 10 in FY '81, to 50 in FY '85, to 65 in FY '86.

- Review of a Broader Range of Issues. In FY '86, SAB carried out, for the first time, reviews for the enforcement office and an EPA Regional Office (Region III in Philadelphia).

- Increasing Participation in Radiation Related Activities. The agenda of the Board's Radiation Advisory Committee included the following issues this past fiscal year: radon epidemiology proposal submitted by the Maine Medical Center; design of the National Radon Survey; technical support documents for radionuclide standards in drinking water; radon mitigation efforts; EPA's Idaho Radionuclide Study; and risks associated with indoor radon exposure.

- Congressional Requests for SAB Reviews. Amendments to the Safe Drinking Water Act require EPA to provide SAB with the opportunity to provide its scientific advice on drinking water issues and standards.

- Public Participation. The SAB solicits the nomination of qualified scientists and engineers by the public. Public participation routinely occurs at SAB meetings through scientific presentations delivered by scientists and engineers from academia, industry, public interest groups, research institutes and international scientific bodies.

- Greater Awareness of SAB Activities. The SAB's Monthly Report summarizes the Board's recent activities for all senior EPA officials. In addition, it is distributed externally to several hundred individuals and organizations. Congressional testimony by SAB members or staff and presentations at scientific and other conferences have also enhanced the public's understanding of the SAB's role.

II. Guidelines for an Effective Scientific Advisory Process

As the Science Advisory Board's role in EPA decision making has evolved, various ad hoc or informal guidelines have emerged as indications of its performance and relationship with EPA. These guidelines comprise reference points or benchmarks for discussing the effectiveness of independent peer review by scientific committees in the regulatory process, the quality of science used in EPA decision making and, finally, the degree and quality of the dialogue between members of the scientific community and EPA. Such guidelines might apply to all regulatory agencies. They include:

- Program officials should believe there is a positive incentive, or, phrased another way, the absence of a negative incentive, to invite the participation of external scientists and engineers into their decision process. These incentives may include the desire for a scientifically acceptable assessment of public health or environmental risks; or a concern about criticism if a scientifically inadequate document is used as a basis for decision making.

- In submitting a document for review by independent scientific committees, the regulatory agency staff need to make explicit both the process and the logic by which they evaluated studies on the toxicity of a particular pollutant, calculated dose response functions, integrated exposure data with the toxicity data, and arrived at a number or range of numbers that express the likelihood of the risk of a health or environmental effect. In other words, staff should explicitly state the chain of scientific logic leading them to a particular scientific conclusion.

- Independent peer review must be carried out early in the decision making process. Two advantages of earlier involvement that are not present at later stages include: 1) it is easier to separate risk assessment and risk management issues (SAB limits its reviews to risk assessment related issues); and 2) there is usually greater flexibility in addressing and resolving technical issues before an agency has formally proposed a particular regulatory action.

- Scientific advisors, besides having stature and authority within their professions, must deliver their advice in a timely manner and in a way that addresses the practical problems of the regulatory agency. For scientific advice to be used in the regulatory process, it should be transmitted in a form and according to a timetable that is compatable with the agency's needs. This assumes, of course, that scientific advisors receive appropriate lead time to review technical documents and prepare scientific reports.

- Scientific advisors need to know if their advice will or will not be taken. Most scientists don't expect that their advice will be completely accepted, but they strongly desire that the regulatory agency inform them of the degree to which it will use such advice and, if not, why not.

- Scientists should interact with both the staff and senior managers of an agency on a frequent basis, and not only at formally scheduled public meetings. There is a need for frequent and less formal exchanges that can serve to clarify the objectives and operating methods of peer reviewers, while building personal trust between the advisors and the agency, and avoiding surprises. Agency officials should not be surprised at the conclusions of their advisors and, in addition, they should have the opportunity to discuss the advisors' findings before a final report is issued. In the business of providing scientific advice, familiarity breeds trust and understanding and need not jeopardize independence.

- There must be continuity in the membership of advisory committees. This is necessary to develop a sense of institutional memory between the advisors and the agency, to avoid duplication and assure the accuracy of scientific advice. Continuity also promotes more predictable and efficient committee review procedures, induces a common sense of mission among committee members and enhances the

liklihood that a regulatory agency will give more serious consideration to an advisory report, if only because the advisory relationship is a continuing one. Continuity of membership does not remove the need for a routine process of rotating scientists and engineers on and off committees on a periodic basis to introduce new scientific views and perspectives.

- Scientific advisory committees or boards should adopt explicit guidelines to protect themselves from conflict of interest or the appearance of conflict of interest. Such guidelines can enhance both the integrity and the authority of the advisory process.

- The scientific advisory process must be a public process. This is necessary not only to comply with certain legal requirements of the Federal Advisory Committee Act but also to ensure the credibility of the scientific review process. A public advisory process, allowing some form of public participation, can yield several important benefits. It can lead to the introduction of new and important scientific information by members of the public, it enables the regulatory agency to identify public concerns before it issues a formal proposed regulation, and it can lead to consensus on key scientific issues in a manner that is more acceptable to the public because of the openness of the advisory proceedings.

These guidelines do not constitute absolute requirements for a scientific advisory process, nor are they the only guidelines that can be articulated. But in the experience of the Science Advisory Board, they have proven to be reliable and durable indicators for guiding and evaluating the Board's performance and its working relationship with EPA.

III. The SAB Review Process

The advisory process employed by the Science Advisory Board may vary depending on the nature of the issues undergoing review, but certain features remain constant throughout all reviews.

Most issues evaluated by the Board are technical support documents prepared internally or by external contractors that are used by EPA program offices in developing regulations, standards, guidance or policy statements. The SAB also evaluates a considerable number of individual programs within the Office of Research and Development. In generic terms the SAB review process can be displayed in the following flow diagram:

SAB Review Process for Technical Support Documents Used in the EPA Regulatory and Research Planning Processes

1. Priority setting and developing the scientific review agenda.

2. Issues referred to SAB for review.

3. SAB Executive Committee refers issues to a standing committee or establishes a new subcommittee. Additional expertise recruited, if needed.

4. Factfinding Agency documents transmitted to SAB panel. Preliminary briefings or site visits conducted, if needed.

5. Agency documents formally reviewed in public meetings. Public comments are accepted. SAB derives a statement on the scientific adequacy of the documents.

6. SAB committee prepares report of its major conclusions and recommendations and transmits it to the Executive Committee for approval.

Based upon SAB and EPA discussions, a second draft of the document may be prepared (if so, step 5 is repeated).

7. Executive Committee review of reports. If approved, report is sent to the Administrator. At this point the SAB report becomes a public document.

8. EPA formally responds to SAB advice by noting areas where advice will be taken or not taken.

IV. Scientific Reviews Conducted During FY '86

As previously noted, FY '86 was the most active year in the history of the Board. Some of the scientific issues reviewed carried over from the previous fiscal year, and some reviews initiated in FY '86 will be completed in FY '87. The majority of activities began and terminated in FY '86.

By category of activity, the following issues constitute the SAB's agenda for FY '86:

Research Program Reviews

- Alternate Hazardous Waste Control Technologies
- Biotechnology
- Dioxins
- Ecological Risk Assessment
- Extrapolation Modeling
- Forest Effects
- Indoor Air Pollution
- Integrated Air Cancer Program
- Radon Mitigation Program
- Welfare Effects Assessment Associated with National Ambient Air Quality Standards (NAAQS)
- NAAQS Research Needs for Ozone and Lead (2 issues)
- Scientific and Technological Achievement Awards Program
- Office of Environmental Engineering and Technology Five Year Research Program
- Radiation Research Needs
- Water Quality Based Approach Research Program
- Superfund Innovative Technology Evaluation
- FY '87 Budget Proposal for the Office of Research and Development

Reviews of the Technical Bases of Regulations and Standards

- Dioxin Toxic Equivalency Methodology
- Health Assessment Documents for Beryllium, Dibenzofurans, Nickel and Tetrachloroethylene (4 issues)
- Water Quality Criteria for Dissolved Oxygen
- Relative Risk Coefficients for Radon
- Technical Support Documents for Low-Level Radioactive Waste Disposal Standards
- Radionuclides in Drinking Water: Radon, Uranium, Radium, Man-Made Radionuclides and Advanced Notice of Proposed Rulemaking (5 issues)
- Review of Technical Criteria for Establishing Alternate Concentration Limits
- Review of Regulations for Ocean Dumping (with assistance from the Army Corp of Engineers Environmental Advisory Board)
- Reuse/Disposal of Sewage Sludge
- Definition of Vulnerable Hydrogeology for Establishing RCRA Location Guidance Standards
- Drinking Water Criteria Documents for Monochlorobenzene, Nitrate, Nitrite (3 issues)
- Quantitative Toxicological Evaluation of Beryllium in Drinking Water
- National Ambient Air Quality Standards for Lead, Ozone and Particulates (3 issues)
- Office of Toxic Substances Risk Assessment for Formaldehyde
- Municipal Waste Combustion Assessment and Research Needs
- Stratospheric Ozone Staff Paper

Technical Reviews of Agency Policy Statements or Guidance

- Risk Assessment Guidelines for Carcinogenicity, Complex Mixtures, Developmental Effects, Exposure Assessment and Mutagenicity (5 issues)
- Technical Enforcement Guidance Document for Ground Water Monitoring
- Scientific Criteria for Development of an Acute Toxics List

Methodology Reviews

- Methodology for Assessing Materials Damage from SO_2 and Acid Rain

EPA Advisories (3 separate reports)

- Office of Drinking Water Health Advisories for 37 Compounds: acrylamide, benzene, p-dioxane, ethylbenzene, ethylene glycol, hexane, legionella, methylethylketone, styrene, toluene, xylene, arsenic, barium, cadmium, chromium, cyanide, lead, mercury, nickel, nitrate/nitrite, carbon tetrachloride, chlorobenzene, dichlorobenzene, 1,2-dichloroethane, cis and trans 1,2-dichloroethylene, 1,1-dichloroethylene, dichloromethane, dichloropropane, dioxin epichlorohydrin, hexachlorobenzene, polychlorinated biphenyls, tetrachloroethylene, 1,1,2-trichloroethylene, 1,1,-trichloroethylene, and vinyl chloride.

Non Research Program Reviews

- Integrated Environmental Management Program

Specific Proposals, Studies or Surveys

- Region III/Office of Policy, Planning and Evaluation Kanawha Valley Study
- National Dioxin Study
- Radon Epidemiology Proposal from the Maine Medical Center
- Idaho Radionuclide Study

SAB Resolutions or Letter Reports to the Administrator or to Congress

- Superfund Resolution
- Letter to Senator David Durenberger and other House-Senate conferees presenting SAB comments on amendments to the Safe Drinking Water Act as they pertain to the additional scientific review responsibilities of the SAB.
- Letter to the Administrator regarding the creation of an advisory committee to provide a continuing independent review of technical data before the issuance of biotechnology experimental use permits.
- Peer Review of Health Effects Institute Research Reports.
- Integration of Risk Assessment

Subcommittees of Major Standing Committees

CASAC

- Materials Damage/SO_2 Subcommittee
  Chair: Dr. Warren Johnson

- Ozone/Lead Research Review Subcommittee
  Chair: Dr. Morton Lippmann

- Welfare Effects Research Review Subcommittee
  Chair: Dr. Warren Johnson

EHC

- Drinking Water Subcommittee
  Chair: Dr. Robert Tardiff

- Halogenated Organics Subcommittee
  Chair: Dr. John Doull

- Metals Subcommittee
  Chair: Dr. Bernard Weiss

EEC

- Hazardous Waste Alternative Technology Research Review Subcommittee
  Chair: Dr. Raymond Loehr

- Alternate Concentration Limits Subcommittee
  Chairs: Dr. Richard Conway
  Dr. Mitchell Small

RAC

- Drinking Water Subcommittee for Radionuclides
  Chair: Dr. Warren Sinclair

- Radioepidemiology Subcommittee
  Chair: Dr. Seymour Jablon

- National Radon Survey Design Subcommittee
  Chair: Dr. Oddvar Nygaard

- Radon Mitigation Subcommittee
  Chair: Dr. John Till

EETFC

- Municipal Waste Combustion Subcommittee
  Chair: Dr. Rolf Hartung

- Water Quality Based Approach Research Review Subcommittee
  Chair: Dr. Kenneth Dickson

- Water Quality Criteria Subcommittee
  Chair: Dr. John Neuhold

SAB COMMITTEES AND SUBCOMMITTEES ACTIVE DURING FY '86

Administrator
Deputy Administrator
Science Advisory Board
Executive Committee
Chairman: Norton Nelson
Director: Terry F. Yosie

Programmatic Subcommittees

- National Dioxin Study Research Review Subcommittee
  Chairman: Dr. Robert Huggett
  Executive Secretary: Dr. Terry F. Yosie
- Dioxin Toxic Equivalency Factor Review Subcommittee
  Chairman: Dr. Richard Griesemer
  Executive Secretary: Dr. Terry F. Yosie
- Integrated Environmental Management Subcommittee
  Chairman: Dr. Ronald Wyzga
  Executive Secretary: Dr. Terry F. Yosie
- Acute Toxics List Criteria Review Subcommittee
  Chairman: Dr. John Doull
- Executive Secretary: Dr. Terry F. Yosie
  Risk Assessment Guidelines Review Group*
  Chairman: Dr. Norton Nelson
  Executive Secretary: Dr. Terry F. Yosie
- Stratospheric Ozone Assessment Subcommittee
  Chairman: Dr. Margaret Kripke
  Executive Secretary: Dr. Terry F. Yosie

Note: All SAB Subcommittees are generally created for single activity reviews and are abolished when they submit their reports to the Executive Committee. In contrast, the role of SAB Standing Committees is a continuing one. Standing Committees can also create subcommittees as a mechanism to conduct specific scientific reviews.

* Has completed its reviews and no longer exists

Research Review Subcommittees

- Study Group on Biotechnology*
  Chairman: Dr. Martin Alexander
  Executive Secretary: Mr. Robert Flaak
- Forest Effects Review Panel*
  Chairmen: Dr. A. Legge & Dr. W. Smith
  Executive Secretary: Mr. Robert Flaak
- Dioxin Research Review Subcommittee*
  Chairman: Dr. Robert Huggett
  Executive Secretary: Dr. Terry F. Yosie
- Extrapolation Modeling Research Review Subcommittee
  Chairman: Dr. Ronald Wyzga
  Executive Secretary: Dr. Daniel Byrd
- Water Quality Based Approach Research Review Subcommittee (conducted under the auspices of the EETF)
  Chairman: Dr. Kenneth Dickson
  Executive Secretary: Dr. Terry F. Yosie
- Ecological Risk Assessment Research Review Subcommittee
  Chairman: Dr. G. B. Wiersma
  Executive Secretary: Dr. Terry F. Yosie
- Integrated Air Cancer Research Review Subcommittee
  Chairman: Dr. George Hidy
  Executive Secretary: Ms. Kathleen Conway
- Indoor Air Pollution Research Review Subcommittee
  Chairman: Dr. Jan Stolwijk
  Executive Secretary: Mr. Robert Flaak
- Hazardous Waste Alternative Technology Research Review Subcommittee (conducted under the auspices of the EEC)*
  Chairman: Dr. Raymond Loehr
  Executive Secretary: Mr. Harry Torno
- Scientific and Technological Achievement Awards Subcommittee
  Chairman: Dr. James Whittenberger
  Executive Secretary: Ms. Kathleen Conway
- FY '87 Research Budget Review Subcommittee
  Chairman: Dr. John Neuhold
  Executive Secretary: Dr. Terry F. Yosie

PERMANENT STANDING COMMITTEES

CLEAN AIR SCIENTIFIC ADVISORY COMMITTEE (CASAC)
Chairman: Dr. Morton Lippmann
Executive Secretary: Mr. Robert Flaak

ENVIRONMENTAL EFFECTS, TRANSPORT (EETFC) AND FATE COMMITTEE
Chairman: Dr. Rolf Hartung
Executive Secretary: Ms. Jan Kurtz

ENVIRONMENTAL ENGINEERING COMMITTEE (EEC)
Chairman: Dr. Raymond Loehr
Executive Secretary: Mr. Eric Males

ENVIRONMENTAL HEALTH COMMITTEE (EHC)
Chairman: Dr. Richard Griesemer
Executive Secretary: Dr. Daniel Byrd

RADIATION ADVISORY COMMITTEE (RAC)
Chairman: Dr. William Schull
Executive Secretary: Ms. Kathleen Conway

SCIENCE ADVISORY BOARD FISCAL YEAR 1986 BUDGET

Compensation (Members, Consultants & Staff)	$1,010,400
Travel	288,500
Purolator And Local Delivery Services	3,200
Conference Room Rentals	4,000
Federal Register Printing	6,000
Other Contractual Services (court reporting services, training, maintenance for word processing equipment, copying machine etc.)	32,100
Supplies	6,100
Equipment	5,300
TOTAL	$1,355,600

SCIENCE ADVISORY BOARD STAFF

DIRECTOR	Terry F. Yosie
Program Analyst	Cheryl B. Bentley
Secretary	Joanna A. Foellmer
Clerk-Typist	Jane Mitchell
DEPUTY DIRECTOR	Kathleen W. Conway
Secretary	Janet R. Butler
CLEAN AIR SCIENTIFIC ADVISORY COMMITTEE	
Environmental Scientist	A. Robert Flaak
Secretary	Carolyn L. Osborne
ENVIRONMENTAL EFFECTS TRANSPORT AND FATE COMMITTEE	
Environmental Scientist	Janis C. Kurtz
Secretary	Lutithia V. Barbee
ENVIRONMENTAL ENGINEERING COMMITTEE	
Environmental Engineer	Eric H. Males (Acting)
Environmental Engineer	Harry Torno (On one-year leave of absence)
Secretary	Brenda A. Browne
ENVIRONMENTAL HEALTH COMMITTEE	
Environmental Scientist	Daniel M. Byrd
Secretary	Frederica O. Jones
RADIATION ADVISORY COMMITTEE	
Environmental Scientist	Kathleen W. Conway
Secretary	Dorothy M. Clark

VI. SAB Reports Issued During FY 1986

Report to the Administrator on a review of a draft document entitled "Preliminary Assessment of Health Risks to Garment Workers and Certain Home Residents from Exposures to Formaldehyde" prepared by the Office of Pesticides and Toxic Substances (OPTS)--Environmental Health Committee—October 1, 1985--SAB-EHC-86-001.

> The Committee concluded that formaldehyde is a carcinogen for rodents by the inhalation route and that the weight of the evidence category under EPA's new guidelines is "sufficient." The Committee found commendable the use of modern nomenclature, analysis of exposure, integration of hazard with parallel quantitative estimates, each one testing an assumption.

Report to the Administrator on a review of the March 13, 1985 draft Background Information Document to accompany the Agency's proposed standards on low-level radioactive waste disposal--Radiation Advisory Committee--October 28, 1985—SAB-RAC-86-002.

> The Committee believes that the Background Information Document, on the whole, provides a reasonable presentation of the potential sources and risks associated with the disposal of low-level radioactive wastes. However, there are deficiencies in parts of the document for which the Committee has suggested extensive revisions to be made before publication. The Committee's major findings are detailed in the report.

Letter Report to the Administrator on the Environmental Engineering Committee Resolution concerning Superfund expenditures--Environmental Engineering Committee-October 30, 1985--SAB-EEC-86-003.

> The Environmental Engineering Committee expresses its concerns in a resolution about enormous expenditures being made under Superfund without an adequate technological data base to support rehabilitation of both public and private hazardous waste disposal sites. The Committee recommends using Superfund monies for a comprehensive research and development program.

Letter report to Senator David Durenberger presenting SAB comments on the amendments to the Safe Drinking Water Act enacted by the House of Representatives and the Senate as they pertain to the additional scientific review responsibilities envisioned for the SAB--Executive Committee—November 4, 1985—SAB-EC-86-004.

> Both houses of the Congress have requested the SAB's early participation in the review of the development of drinking water regulations and standards. The SAB will provide its technical evaluation prior to the proposal of maximum contaminant level (MCL) goals and national primary drinking water regulations.

SINGLE COPIES OF THESE REPORTS ARE AVAILABLE AT NO CHARGE FROM THE SCIENCE ADVISORY BOARD. PLEASE ADDRESS REQUESTS TO SCIENCE ADVISORY BOARD (A-101F), ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, D.C. 20460, ATTENTION CHERYL B. BENTLEY OR CALL (202) 382-2552.

Report to the Administrator on the Radiation Advisory Committee's response to the Office of Radiation Program's request to provide assistance in establishing emergency criteria applicable to elevated indoor radon concentrations in structures built on the Reading Prong--Radiation Advisory Committee--November 5, 1985--SAB-RAC-86-005.

The Committee's advice was sought on two issues:

(1) Is a range of relative risk coefficients of 1.2 to 2.8% a reasonable range for the Agency to use in evaluating the risks associated with exposures at and above various alternative interim emergency action levels for the Reading Prong? The Committee's consensus was that the range 1.2-2.8% was too narrow. Reasonably good data are available that give values as low as 0.31%

(2) Are there any special considerations that should be taken into account in calculating the risks associated with short-term exposures to radon decay products versus lifetime exposures? The Committee is collectively aware of no convincing evidence that short-term exposures to radon or to other sources of ionizing radiation impose a smaller risk per unit exposure (in this case WLM) than do long-term exposures. However, the Committee pointed out that the risk estimates cited stem from studies of occupationally exposed adults and may underestimate the risk to children in whom a given environmental radon level results in a higher radiation dose to the lungs than in adults.

Report to the Administrator on the Science Advisory Board's review of the Office of Research and Development's Forest Effects Research Program--Forest Effects Review Panel--November 1985--SAB-EC-86-006.

The review panel examined the Agency's research plan for forest dieback/decline at three different levels: 1) organization of the research program, 2) specific research designs and plans, and 3) integration of research results.

Report to the Administrator on a Review of the RCRA Ground Water Monitoring Technical Enforcement Guidance Document--Environmental Engineering Committee--June 24, 1986--SAB-EEC-86-007.

The Committee was requested by the Office of Waste Programs Enforcement (OWPE)) to review its draft document entitled "RCRA Ground Water Monitoring Technical Enforcement Guidance Document"(TGED). The document concerns the technical aspects of ground water monitoring at Resource Conservation and Recovery Act (RCRA) facilities.

The Committee concluded that a TEGD document that it reviewed was badly needed and represented a good start for setting consistent standards for establishing and evaluating ground water monitoring efforts. The Committee concluded that the majority of the TEGD is technically sound, and it made a number of recommendations for improvement that are included in the report. The Committee also suggested that the Agency should emphasize that the TEGD is neither a regulation nor an "engineering handbook," and that flexibility, highly trained and experienced personnel, and professional judgment should be used by both EPA and those implementing ground water monitoring systems.

Report to the Administrator on health effects information relating to particulate matter that has become available since the Committee's last official review—Clean Air Scientific Advisory Committee--January 2, 1986—SAB-CASAC-86-008.

CASAC's preliminary view indicates that the new data does not require a fundamental alteration of the structure of the proposed particulate standards and does not fundamentally change CASAC's understanding of the mechanisms by which particulate exposures effect public health. However, the Committee and many members of the public have serious concern as to whether the current proposed ranges of interest are as scientifically supportable as they were in November 1981 when last examined by CASAC. The Committee made three major recommendations: 1) that an addendum to the existing particulate matter criteria document be prepared; 2) that an addendum to the existing particulate matter staff paper be prepared; and 3) that the Agency prepare an issues paper evaluating the scientific issues pertaining to acidic aerosols.

Report to the Administrator on a preliminary evaluation of the Agency's existing research and risk assessment capabilities associated with the field application of genetically engineered organisms—Biotechnology Study Group—January 1986-SAB EC-86-009.

The Study Group was requested to undertake a preliminary evaluation of the Agency's existing research and risk assessment capabilities associated with the field application of genetically engineered organisms. The Group concluded that although the Agency has increased its research staff and initiated a research program in biotechnology, a larger and broader program than that envisioned is needed by EPA decision makers. Evaluation of environmental effects, in particular, is an issue which should receive high priority by EPA. The Study Group endorsed EPA's current regulatory approach toward this developing industry.

Report to the Administrator on Alternate Concentration Limits for releases from RCRA-permitted hazardous waste disposal facilities--Environmental Engineering Committee—May 8, 1986--SAB-EEC-86-010.

At the request of the Office of Solid Wastes (OSW), the SAB's Environmental Engineering Committee reviewed a draft Agency guidance for the establishment of Alternate Concentration Limits (ACL) for RCRA facilities, and two case studies demonstrating applications of that guidance. The Committee identified only obvious technical errors or omissions which are explained in detail in the report. OSW will seek a more comprehensive scientific review when it prepares a final draft of the ACL guidance.

Report to the Administrator on a review of the Agency's research program for dioxin--Dioxin Research Review Subcommittee--January 24, 1986-SAB-EC-86-011.

The Subcommittee reviewed the status of research being conducted to assess and control the hazards posed by dioxin. Highlights of the report include the Subcommittee's findings that EPA has made substantial progress in a number of areas in support of the Dioxin Strategy and that the Agency needs to more carefully define and articulate its health effects research role and capability with respect to other Federal agencies.

Review of the Office of Environmental Engineering and Technology's (OEET) five-year research plan--Environmental Engineering Committee—February 14, 1985--SAB-EEC-86-012.

The Committee was requested by the Director of OEET to review three sample five-year research plans being prepared for 27 topics currently under study by OEET. The five-year research plan's purpose is to describe the EPA/ORD programs to EPA program offices, the scientific and engineering community, other interested groups, and to serve as a basis for budgetary planning.

The Committee reviewed the following research plans—(1) Hazardous Waste-Land Disposal, (2) Drinking Water, and (3) Limestone Injection Multistage Burner (LIMB), and applauds OEET for its development of these and other five-year research plans. The three are sensitive to the Agency program offices' needs and were well done and will be helpful in describing the present and future research of OEET to the program offices and to the scientific and engineering community.

The five-year planning period is appropriate in that it provides for some continuity, is compatible with the Federal budgeting cycle, and yet does not extend so far into the future as to lose its reality.

Review for the Office of Environmental Engineering and Technology (OEET) of a report prepared by the ICF Corporation entitled "Pollution Control Technology Research and Development: Private Sector Incentives and the Federal Role in the Current Regulatory System."--Environmental Engineering Committee--October 1985-SAB-86-EEC-013.

This review was a part of a continuing series of interactions between the Director of OEET and the Committee, and reflects the Committee's continuing interest in the technology R&D program in EPA. The objectives of the ICF report were: 1) to develop a conceptual framework which can be used to determine what amount of pollution control technology R&D is optimal from society's perspective; 2) to identify any types of pollution control technology R&D which are not being carried out to a sufficient degree by the private sector in the current regulatory system; and 3) to propose ways that EPA can encourage or work to ensure that more of that R&D is done. The Committee agreed with the recommendations presented in the ICF report which are summarized as follows:

1) There is a need for a Federally and privately funded R&D program for pollution control technology, which is seriously underfunded at the present time.

2) Further investigation should be made into alternative approaches to the current system for R&D funding by EPA.

3) EPA cost sharing/joint ventures with private industries should be increased wherever feasible.

4) The Agency should investigate the feasibility of establishing additional control technology research centers. As an example, there is a particular need for municipal treatment technologies.

5) EPA should implement a more stringent internal review system for control technology development projects.

Report to the Administrator on the creation of an advisory committee to provide a continuing independent review of the technical adequacy of risk assessments prepared by the Agency before granting experimental use permits for Biotechnology Applications—March 3, 1986--SAB-EC-86-014.

The Science Advisory Board's (SAB) Biotechnology Study Group and the Executive Committee assumed that confidential business information (CBI) would constitute a significant portion of the technical data submitted by individuals and organizations seeking an EPA permit, and

that the number of permit petitions would grow significantly in future years. Because the SAB is a public advisory body whose members are not generally cleared for CBI data, it is the Board's recommendation that the new biotechnology scientific advisory committee should be separate from the SAB. In addition, where circumstances warrant, it would be useful to have overlapping membership between this committee and the SAB.

Report to the Administrator on a review of the proposed Fiscal Year (FY) 1987 budget for the Office of Research and Development—Executive Committee-March 14, 1986-SAB-EC-86-015.

The Science Advisory Board believes that it can assist the Congress in developing a more informed basis in reaching budgetary decisions for the Office of Research and Development. This view is based on a large number of EPA research program evaluations that the SAB has conducted during the past several fiscal years, as well as to the experience of individual SAB members in carrying out or managing research, and their knowledge of EPA's research efforts.

The FY'87 budget does not greatly change in direction or support of the FY'86 program, which is a stabilizing force. A more serious problem is the use of funds available for extramural research and development and funds devoted to in-house use. EPA's in-house program is underfunded in contrast to most Federal public health and environmental research agencies. An alternative would be for Congress to substantially raise the current ceiling of $1,000,000 before EPA is required to seek Congressional approval for reprogrammings within extramural or in-house accounts, or to authorize EPA to reprogram funds between extramural and in-house accounts. However, any funds that come from extramural budget should be earmarked for the Office of Research and Development.

Report to the Administrator on the Review of "Permit Writers" Guidance Manual for the location of Hazardous Waste Land Treatment, Storage and Disposal Facilities Phase II-Environmental Engineering Committee-June 1986-SAB-EEC-86-016

The Science Advisory Board (SAB) was requested by the Office of Solid Waste (OSW) to review the draft document listed above. This guidance was prepared by OSW in response to a requirement in Section 3004(o)(7) of RCRA, which requires the Agency to publish "guidance criteria" for identifying areas of vulnerable hydrogeology and to promulgate regulations specifying criteria for the acceptable location of new and existing RCRA facilities. SAB's Environmental Engineering Committee (EEC) conducted this review. In general the Committee's findings were: (1) the Phase II location Guidance is a clear and logical presentation of criteria to be used in evaluating "vulnerable" hydrogeology; (2) the methodology described in the

Guidance is suitable for use with well-prepared existing permit application data (though the Committee notes that only a small fraction of the Part B's actually have enough information for making time-of-travel calculations; and (3) the methodology is not detailed enough to make a complete site-specific determination, but is an appropriate method for "triggering" more detailed analysis. Specific comments are detailed in the report.

Time-of-Travel-Concept--Although simplistic, the time-of-travel (TOT) concept is technically sound, and integrates various aspects of hydrogeology into a single measure reflecting the potential for pollutant migration and exposure. The TOT concept depends heavily on the determination of effective porosity, hydraulic gradient and hydraulic conductivity, and the guidance should be more explicit in how data should be collected and used to make these determinations.

10/100 Year Time Frames--The technical analysis in Appendix D and the Case Studies do not adequately support the time frames specified in the proposed criteria (10 years for treatment and storage facilities, 100 years for disposal facilities). Other studies should be conducted.

Adequacy of the 100-foot Flow Line Distance--The selection of a 100-foot flow line is a conservative, practical engineering criterion, and as such is adequate for the purposes of the guidance, but it cannot be justified on the basis of hydrogeologic homogeneity or flow pattern predictability.

Additional Factors to be Considered--The guidance should include some means of evaluating the effects of seasonal variation on hydraulic gradient, as well as the effects on TOT calculations of the physical and kinetic characteristics of the toxic substances (such as partitioning or decay).

Report to the Administrator on the Review of the "Superfund Innovative Technology Evaluation (SITE) Program—Environmental Engineering Committee-June 1986-SAB-EEC-86-017

In October 1985 the Environmental Engineering Committee (EEC) expressed its concern in a resolution to the Administrator of EPA that enormous expenditures were being made under Superfund without an adequate technological data base to support rehabilitation of both public and private hazardous waste disposal sites. The Administrator responded to EEC's resolution and stated that he agreed and noted that the Office of Research and Development (ORD) and the Office of Emergency and Remedial Response were developing a strategy for a Superfund Innovative Technology Evaluation (SITE) Program to address some of these issues.

At an EEC October 21-22, 1985 meeting, the Director of the Office of Environmental Engineering and Technology in ORD asked the EEC to review the SITE program. The Committee reviewed the Agency's draft plan, which incorporated some important components necessary to the implementation of an effective research, development and demonstration program, and found the following major strengths: (1) a clear exposition of the problem, and the goals and objectives of the Program; (2) a succinct summary of the impediments to the development and use of alternative technologies; and (3) the emphasis on getting the Program moving without waiting to be sure that all problems have first been resolved.

The Committee recommended that in order for the Plan to be effective, it must: (a) have the endorsement of the Administrator and other senior officials of EPA, (b) be recognized as a long-term (at least 5 years) effort and commitment, (c) be adequately supported with personnel and funds on a sustained basis and (d) have dedicated EPA personnel at Headquarters, at specific research laboratories and in the regions.

The Committee stressed the importance that senior EPA staff clearly understand this, otherwise the SITE Program will not achieve its desired success and will result in a waste of scarce financial and human resources.

Report to the Administrator on Ways in which EPA and the Environmental Health Committee can enhance their efficiency in carrying out joint responsibilities in preparing and reviewing risk assessments--Environmental Health Committee--April 8, 1986--SAB-EHC-86-018

The Committee identified several areas in which the Agency could enhance risk assessments, such as integration of hazard and exposure data, comprehensive scope of assessments, cut off dates for literature reviews, use of more modern terminology, elimination of inconsistency of nomenclature and assignment of priorities for reviews.

With respect to the issue of multiple documents for the same pollutants, the Committee recommended that the Agency utilize a core document as a means of critically evaluating available health and exposure data to meet the needs of all program offices. This approach would permit joint planning by EPA programs to identify their individual and collective technical assessment needs for future documents and the use of one core document as the technical basis for program-specific regulatory activities. Media-specific assessments should be regarded as supplements to the core document.

Report to the Acting Assistant Administrator for Research and Development on the 1985 Scientific and Technological Achievement Awards--1985 Scientific and Technological Achievement Awards Subcommittee-March 4, 1986-SAB-EC-86-019

The Subcommittee reviewed 92 papers nominated by EPA's Office of Research and Development for the 1985 Scientific and Technological Achievement Awards; 24 were recommended for awards. The Subcommittee's comments included general observations about the nominations and the nomination process, and repeated a suggestion made previously that would permit a better evaluation of the Awards Program. This suggestion involved the impression of the Subcommittee members that the number nominated from different laboratories were very uneven, and that the numbers may not reflect accurately the quality and quantity of research in a laboratory. Subcommittee members did not know what factors in the nomination process lead to this unevenness, and were not able to assess the extent of the problem until "denominator" information was provided; that is, what fraction of the total peer-reviewed publications from a given laboratory unit are represented by the number nominated for a given year? This may be sensitive information, but it would be very useful in evaluating the effectiveness of the nomination process.

In addition, the Subcommittee raised the question of whether to evaluate the overall accomplishments of the Program.

Report to the Administrator on a review of the Agency's Ambient Water Quality Criteria Document for Dissolved Oxygen—Fresh Water Aquatic Life—Environmental Effects, Transport, and Fate Committee-April 18, 1986-SAB-EETSFC-86-020

The SAB assessed six major scientific issues including: the invertebrate problem; laboratory-field implications; additive stresses and chemical interactions; growth rate reductions; oxygen criteria levels; and dissolved oxygen monitoring conditions. In general, the Board concludes that the document is well-organized and researched and whose logic and conclusions are scientifically defensible.

Report to the Acting Chairman of the U.S. Consumer Product Safety Commission (CPSC) on a review conducted by the Clean Air Scientific Advisory Committee on the health effects and exposure assessment documents on nitrogen dioxide—May 9, 1986-SAB-CASAC-86-021.

At the request of the Consumer Product Safety Commission, the Clean Air Scientific Advisory Committee conducted a review on the potential health hazards associated with exposure to 0.1 to 1.0 ppm nitrogen

dioxide generated by unvented indoor combustion sources. The Committee concluded that: 1) repeated peak exposures at concentrations of 0.3 ppm of nitrogen dioxide may cause health effects in some individuals, and there is a possibility that such effects may occur at concentrations as low as 0.1 ppm; 2) the population groups that appear most sensitive to nitrogen dioxide exposure include children, chronic bronchitics, asthmatics, and individuals with emphysema; and 3) the most direct evidence regarding lung damage associated with nitrogen dioxide is obtained from animal studies--such studies conclude that a number of effects occur in a variety of animal species, many of which can be considered serious and irreversible.

Report to the Administrator on a review of the Assessment of Welfare Effects Research Needs for Setting National Ambient Air Quality Standards--Clean Air Scientific Advisory Committee—PENDING—SAB-CASAC-86-022

Report to the Administrator on the Lead Criteria Document-Clean Air Scientific Advisory Committee--August 28, 1986—SAB-CASAC-86-023

This report documents the Committee's findings relative to its review of the final Air Criteria Document for Lead, and its 1986 Addendum which further evaluated the recent research concerning the relationship between blood-lead and hypertension and the effects of lead exposure on childhood growth and stature. The Committee unanimously concluded that both documents represent a scientifically balanced and defensible summary of the current basis of our knowledge of the health effects literature for this pollutant

Report to the Administrator on recommendations on Lead Staff Paper-Clean Air Scientific Advisory Committee--August 29, 1986—SAB-CASAC-86-024

In reviewing the second external review draft of the Staff Paper for Lead, the Committee found the document to be clear and appropriate. The Committee makes a number of recommendations concerning improvements in the form and content of the document.

Report to the Administrator on a Review of the Alternative Technologies Research Program—Environmental Engineering Committee—September 18, 1986—SAB-EEC-86-025

As part of a process for reviewing EPA research programs, the Committee was requested to conduct a review of the Alternative Technologies Research Program at the EPA Hazardous Waste Engineering Research Laboratory (HWERL) in Cincinnati. This broad reviw concentrated on the Program goals and progress in meeting those goals, on the relevance and responsiveness to needs of the Agency's regulatory programs, and on the relationship of the Program to other research being conducted in ORD, elsewhere in EPA and outside of EPA.

The Committee found the Program was well-conceived, balanced and cohesive, and meets the relevant needs of the regulatory program in the Office of Solid Waste and Emergency Response. The Committee also recommended that the waste minimization component of the Program be strengthened, that the process for selecting technologies for evaluation be reviewed, and that consideration be given to streamling the permitting process for the Office of Research and Development test program.

Report to the Administrator on the Draft Health Assessment Document for Nickel--Environmental Health Committee--July 11, 1986--SAB-EHC-86-026

The Committee reviewed a previous version of the document in September 1983 and agreed that the current draft is clearer, more comprehensive, and responsive to its earlier comments. Additional comments were provided which should be incorporated in the final document before its final publication, particularly in the areas of speciation, pharmacokinetics and choose of epidemiology data. The Committee also concluded that the document appropriately characterized the current scientific literature on the carcinogenicity of nickel compounds.

Report to the Administrator on ways in which the Science Advisory Board (SAB) and the Health Effects Institute (HEI) can work together to further their common goal of improving the adequacy of scientific data used in Agency decision making--Executive Committee--August 12, 1986--SAB-EC-86-027

The Committee met with HEI at its July 10-11 meeting to discuss several issues of mutual interest. Following the discussions a consensus was reached on the following:

(1)The Committee concluded that there was a need for a more systematic relationship between SAB and HEI, but both organizations ought to continue to maintain their independence from each other in the course of their mutual interaction.

(2)A reasonable balance between independence and interaction is for SAB to regularly invite HEI selected representatives as observers to its reviews of EPA research programs. Reciprocally, HEI could periodically brief SAB committees on its ongoing research program.

(3) Since EPA will have a keen interest in HEI's research in its rulemaking activities, an important issue is whether to use such data before its appears in a refereed journal. The SAB concluded that journal publication is preferable prior to the use of scientific data in regulatory decision making. The research results HEI sponsors may play a signficant role in EPA's decision making process. As a result, the SAB believes that such data should not be excluded from consideration.

This belief assumes that EPA will continue to conduct its own assessment of the data and make it widely available for public distribution and comment.

Report to the Administrator on a review of the Office of Research and Development's proposal entitled "Health Effects of Waterborne Radon" --Radiation Advisory Committee--September 5, 1986--SAB-86-RAC-028

The Committee formed an Radioepidemiology Subcommittee to to review the scientific merit of a proposal to conduct an epidemiological study of radon in indoor air. Specifically, the Agency requested the Committee to review the following questions:

(1) Can further epidemiological study contribute to an understanding of the risks of lung cancer associated with household radon exposures?

The Subcommittee concluded that scientific uncertainties in current epidemiological studies (chiefly studies of uranium miners) could be further reduced through direct investigations of the domestic population.

(2) Is the proposed study under review by the Office of Research and Development entitled "Health Effects of Waterborne Radon" appropriately designed to address this risk?

For reasons cited in the report, the Subcommittee concluded that it is not appropriately designed.

While supporting the need for epidemiological studies on radon in indoor air, the Subcommittee recommends that the Agency not undertake the study reviewed in this report as it is presently planned.

Report to the Administrator on the Science Advisory Board's initiation of a series of scientific reviews of Agency research programs—Executive Committee--August 29, 1986--SAB-EC-86-029

SAB reviews of research programs have focused both the Board's and the Agency's thinking on research plans and needs to a degree never before achieved through preparation and review of the Five Year Research and Development Plan (Research Outlook). The Board believes that its extensive research program reviews fulfill the spirit and intent of Congress for SAB oversight of the Agency's research program. Comments on specific issues in the five year plan have also been addressed in individual research program reviews.

SCIENCE ADVISORY BOARD MEMBERSHIP

	CURRENT MEMBERS	WHEN APPOINTED	TERMINATION DATE	FORMER SAB SERVICE	CURRENT POSITION
1.	Dr. Seymour Abrahamson Professor of Zoology & Genetics University of Wisconsin Madison, Wisconsin	1/84	9/89	Former SAB Consultant	Member, Environmental Health Committee
2.	Dr. Martin Alexander Professor, Dept. of Agronomy Cornell University Ithaca, New York	12/83	9/88	Former SAB Member	Member, Environmental Effects, Transport & Fate
3.	Dr. Stanley I. Auerbach Director, Environmental Sciences Division, Oak Ridge National Laboratory Oak Ridge, Tennessee	3/86	9/88	None	Member, Executive Committee
4.	Dr. Richard A. Conway Corporate Development Fellow Union Carbide Corporation South Charleston, WV	4/82	9/87	None	Member, Environmental Engineering Committee
5.	Dr. John Doull Professor of Pharmacology University of Kansas Medical Center Kansas City, Kansas	4/82	9/89	FIFRA SAP, 1976-1980	Member, Environmental Health Committee

	CURRENT MEMBERS	WHEN APPOINTED	TERMINATION DATE	FORMER SAB SERVICE	CURRENT POSITION
6.	Dr. Philip E. Enterline Professor of Biostatistics & Director for the Center for Environmental Epidemiology University of Pittsburgh Pittsburgh, PA	10/86	10/89	None	Member, Environmental Health Committee
7.	Dr. Ben B. Ewing Director, Institute for Environmental Studies University of Illinois at Urbana-Champaign Urban, Illinois	4/82	9/87	None	Member, Environmental Engineering Committee
8.	Dr. Davis L. Ford Group Vice President Engineering Science, Inc. Austin, TX	4/82	9/87	None	Member, Environmental Engineering Committee
9.	Dr. Robert Frank The Johns Hopkins School Of Hygiene and Public Health Baltimore, Md	11/83	9/88	Consultant CASAC & Environmental Health Committee Consultant	Member, Clean Air Scientific Advisory Committee
10.	Dr. Sheldon K. Friedlander Parsons Professor of Chemical Engineering University of California at Los Angeles Los Angeles, CA	10/82	9/87	SAB Technology Committee 1975-78 CASAC 1978-1982	Member-At-Large

CURRENT MEMBER	WHEN APPOINTED	TERMINATION DATE	FORMER SAB SERVICE	CURRENT POSITION
11. Dr. Wilford R. Gardner Head, Department of Soils, Water and Engineering University of Arizona Tucson, Arizona	4/82	9/87	None	Member, Environmental Effects, Transport & Fate Committee
12. Dr. Earnest F. Gloyna Dean, College of Engineering University of Texas at Austin Austin, Texas	11/81	9/87	Chair, Executive Committee	Member, Executive Committee
13. Mr. George P. Green Public Service Company of Colorado Manager, Production Services Littleton, CO	5/82	9/88	None	Member, Environmental Engineering Committee
14. Dr. Richard A. Griesemer Director, Biology Division Oak Ridge National Laboratory Oak Ridge, Tennessee	1/85	9/87	None	Chair, Environmental Health Committee
15. Dr. Rolf Hartung Professor of Environmental Toxicology, School of Public Health University of Michigan Ann Arbor, Michigan	4/82	9/87	None	Chair, Environmental Effects, Transport, & Fate Committee
16. Dr. J. William Haun Vice President Engineering Policy General Mills, Inc. Minneapolis, MN	4/82	9/87	None	Member, Environmental Engineering Committee

CURRENT MEMBERS	WHEN APPOINTED	TERMINATION DATE	FORMER SAB SERVICE	CURRENT POSITION
17. Dr. George M. Hidy President Desert Research Institute Reno, NV	4/82	9/87	None	Member, Executive Committee
18. Dr. Robert J. Huggett Senior Marine Scientist Virginia Institute of Marine Science College of William & Mary Gloucester Point, VA	9/84	9/88	Former SAB Consultant	Member, Environmental Effects, Transport, & Fate Committee
19. Dr. Seymour Jablon Director, Medical Follow-up Agency National Research Council Wash., D.C.	12/84	9/88	None	Member, Radiation Advisory Committee
20. Dr. Kenneth D. Jenkins Professor of Biology California State University at Long Beach Long Beach, CA	5/85	9/87	Former SAB Consultant	Member, Environmental Effects, Transport & fate Committee
21. Dr. Warren B. Johnson Director, Atmospheric Science Center SRI International Menlo Park, CA	1/83	9/87	None	Member, Clean Air Scientific Advisory Committee
22. E. Marshall Johnson Professor and Chairman Department of Anatomy Jefferson Medical College Philadelphia, PA 19107	10/85	9/87	Former SAB Consultant	Member, Environmental Health Committee

CURRENT MEMBERS	WHEN APPOINTED	TERMINATION DATE	FORMER SAB SERVICE	CURRENT POSITION
23. Dr. Nancy Kim Director, New York Department of Health Bureau of Toxic Substance Assessment Albany, New York	1/85	9/87	None	Member, Environmental Health Committee
24. Dr. Timothy V. Larson Research Associate Environmental Engineering & Science Program Department of Civil Engineering Seattle, Washington	10/86	10/89	Former SAB Consultant	Member, Clean Air Scientific Advisory Committee
25. Dr. John Laseter Enviro Health Systems Richardson, Texas	1/84	9/87	Former SAB Member	Member, Environmental Effects, Transport & Fate Committee
26. Dr. Terry Lash Director Department of Nuclear Safety Springfield, Illinois	12/84	9/87	Former SAB Consultant	Member, Radiation Advisory Committee
27. Dr. Joseph Ling Vice President Retired Consultant 3M Company St. Paul, MN	7/84	9/88	Former SAB Consultant	Member, Environmental Engineering Committee

CURRENT MEMBERS	WHEN APPOINTED	TERMINATION DATE	FORMER SAB SERVICE	CURRENT POSITION
28. Dr. Morton Lippmann Professor of Env. Medicine Institute of Environmental Medicine New York University Medical Center New York, New York	9/83	9/87	Former SAB Consultant	Chair, Clean Air Scientific Advisory Committee
29. Dr. Raymond Loehr Civil Engineering Department University of Texas Austin, Texas	10/83	9/87	SAB Technology Committee 1976-1981	Chair, Environmental Engineering Committee
30. Dr. William Lowrance Senior Fellow and Director Life Sciences Program The Rockefeller University New York, New York	6/83	9/87	None	Member, Executive Committee
31. Dr. Francis L. Macrina Department of Microbiology & Immunology Virginia Commonwealth University Richmond, Virginia	10/86	10/88	Former SAB Consultant	Member-At-Large
32. Dr. Roger O. McClellan Lovelace Biomedical and Environmental Research Inst. Albuquerque, New Mexico	2/80	9/87	SAB Executive Comm., 1976-1980 Environmental Health Comm., 1980-82 Environmental Health Committee Chair	Member, Executive Committee

CURRENT MEMBERS	WHEN APPOINTED	TERMINATION DATE	FORMER SAB	CURRENT POSITION
33. Dr. Francis C. McMichael Professor of Civil Engineering Carnegie-Mellon University Pittsburgh, PA	6/83	9/87	SAB, Technology Committee, 1979-81 Former SAB Consultant	Member-At-Large
34. Dr. Robert A. Neal President, Chemical Industry Institute of Toxicology Research Triangle Park, NC	11/82	12/87	FIFRA SAP, 1976-80 NDWAC, 1979-82, 1983-85, Former SAB Consultant	Member, Executive Committee
35. Dr. James V. Neel Lee R. Dice University Professor of Human Genetics University of Michigan Medical School Ann Arbor, Michigan	12/84	9/88	Former SAB Consultant	Member, Radiation Advisory Committee
36. Dr. Norton Nelson Professor of Environmental Medicine New York University New York, New York	1/83	9/88	Environmental Health Committee 1975-1979	Chair, Executive Committee
37. Dr. John M. Neuhold Dept. of Wildlife Sciences College of Natural Resources Utah State University Logan, Utah	10/82	9/87	Ecology Committee 1974-1978 SAB Executive Comm., 1980-1982	Chair, Subcommittee on Strategic & Long-Term Research Planning
38. Dr. D. Warner North Principal, Decision Focus, Inc. Los Alto, CA	4/82	9/89	Former SAB Consultant	Member, Environmental Health Committee

CURRENT MEMBERS	WHEN APPOINTED	TERMINATION DATE	FORMER SAB SERVICE	CURRENT POSITION
39. Dr. Oddvar Nygaard Professor of Radiology Director of the Division of Radiation Biology Case Western Reserve University Cleveland, Ohio	12/84	9/88	None	Member, Radiation Advisory Committee
40. Dr. Donald J. O'Connor Professor of Environmental Engineering Manhattan College Bronx, NY	10/83	9/87	None	Member, Environmental Engineering Committee
41. Dr. Charles R. O'Melia Professor, Dept. of Geography and Environmental Engineering John Hopkins University Baltimore, MD	4/82	9/87	None	Member, Environmental Engineering Committee
42. Dr. Charles F. Reinhardt Haskell Laboratory for Toxicology and Industrial Medicine E. I. du Pont de Nemours & Company Newark, Delaware	1/85	9/87	None	Member-At-Large
43. Dr. William J. Schull Director and Professor of Population Genetics Science Center at Houston Houston, Texas	4/82	9/87	Member, Environmental Health Committee	Chair, Radiation Advisory Committee

CURRENT MEMBERS	WHEN APPOINTED	TERMINATION DATE	FORMER SAB SERVICE	CURRENT POSITION
44. Dr. Ellen K. Silbergeld Senior Scientist Toxic Chemicals Program Environmental Defense Fund Washington, D.C.	6/83	9/87	None	Member, Executive Committee
45. Dr. Warren Sinclair President, National Council on Radiation Protection and Measurements Bethesda, Maryland	12/84	9/88	None	Member, Radiation Advisory Committee
46. Dr. Mitchell Small Assistant Professor Department of Civil Engineering Carnegie-Mellon University Schenley Park Pittsburgh, PA 15213	10/85	9/88	Former SAB Consultant	Member, Environmental Engineering Committee
47. Dr. Charles Susskind Professor, Electrical Engineering and Computer Sciences Department University of California at Berkeley Berkeley, CA	6/83	9/88	None	Member, Radiation Advisory Committee
48. Jan A. J. Stolwijk Department of Epidemiology and Public Health Yale University School of Medicine New Haven, Connecticut	6/86	9/88	None	Chair, Indoor Air Research Review Subcommittee

CURRENT MEMBER	WHEN APPOINTED	TERMINATION DATE	FORMER SAB SERVICE	CURRENT POSITION
49. Dr. Robert Tardiff Environ-Corporation Washington, D.C.	1/85	9/87	None	Member, Environmental Health Committee
50. Dr. John Till Private Consultant Neeses, South Carolina	12/84	9/87	None	Member, Radiation Advisory Committee
51. Dr. James Ware Department of Biostatistics Harvard School of Public Health Boston, Massachusetts	8/84	9/87	Former CASAC Consultant	Member, Clean Air Scientific Advisory Committee
52. Dr. Bernard Weiss Professor, Division of Toxicology University of Rochester Rochester, New York	11/84	9/87	Former SAB Consultant	Member, Environmental Health Committee
53. Dr. Jerome J. Wesolowski Air and Industrial Hygiene Lab University of California, Berkeley Berkeley, California	1/86	9/88	None	Member, Clean Air Scientific Advisory Committee
54. Dr. James Whittenberger Southern Occupational Health Center University of California Irvine, CA	12/83	9/87	Environmental Health Committee	Member-At-Large & Long-term Research Planning Subcommittee
55. Dr. Ronald E. Wyzga Program Manager Electric Power Research Institute Palo Alto, CA	11/84	9/89	Former SAB Consultant	Member, Environmental Health Committee