

 **EPA AN SAB REPORT:  
IMPROVING THE EFFICACY  
OF SCIENCE ADVISORY  
BOARD REPORTS – A  
STUDY OF THE  
ATTRIBUTES OF  
SUCCESSFUL TECHNICAL  
REVIEWS**

**REVIEW BY THE  
RETROSPECTIVE  
SUBCOMMITTEE OF THE  
SCIENCE ADVISORY BOARD'S  
ENVIRONMENTAL ENGINEERING  
COMMITTEE**

October 28, 1999

EPA-SAB-EEC-COM-00-001

Honorable Carol M. Browner  
Administrator  
U.S. Environmental Protection Agency  
Washington, DC 20460

Subject: Improving the Efficacy of Science Advisory Board Reviews: A Study of the Attributes of Successful Technical Reviews by the Environmental Engineering Committee

Dear Ms Browner:

One result of the Science Advisory Board's Executive Committee November 1997 retreat was a recommendation that the standing committees review their past activities and products to develop recommendations for improving SAB reviews. The Environmental Engineering Committee formed a Subcommittee in 1998 to undertake this effort and its report on this retrospective study is attached for your consideration. Moreover, the Subcommittee's findings and recommendations have been transmitted to the chairs of all the SAB's standing committees.

The Subcommittee intended to develop persuasive, data-based arguments for changes in the modus operandi within the EEC and, where appropriate, within other parts of the SAB. These changes would help the SAB to make a more positive difference in the value of and in the acceptance of SAB advice to the Agency. The Subcommittee gathered information by examining the impacts of eight of its past reports of various types to discern why some were more effective than others. The Subcommittee also interviewed 13 people having extensive knowledge of the SAB program and products. An additional 22 contacts were made concerning the merits and influence of specific EEC reports.

The Subcommittee's findings and recommendations are summarized in Chapter 4 of the attached report. The issues addressed are:

Topic Selection and Charge

- Going beyond a narrow charge
- Developing a receptive clientele for self-initiated reviews
- Screening proposed topics for importance
- Working closely with Program Offices

### Review Process

- Careful selection of chairs and subcommittee members
- Communicating during a review with stakeholders
- Including minority opinions

### Report Completion

- Planning to meet timeliness requirements
- Framing recommendations to maximize value and impact
- Prioritizing and categorizing recommendations

### Communication and Follow-up

- Briefing sponsoring offices
- Following up on important reports for longer time periods

We hope the Agency, as well as the Board, the EEC and other committees, will find these recommendations to be useful. We appreciate the opportunity to conduct and report on the outcomes of this interesting retrospective study. We look forward to your response.

Sincerely,

/signed/

Dr. Joan Daisey, Chair  
Science Advisory Board

/signed/

Dr. Dr. Hilary Inyang, Chair  
Environmental Engineering Committee  
Science Advisory Board

/signed/

Dr. Ishwar P. Murarka, Chair  
Retrospective Subcommittee  
Environmental Engineering Committee

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## ABSTRACT

"Improving the Efficacy of Science Advisory Board Reviews: A Study of the Attributes of Successful Technical Reviews by the Environmental Engineering Committee" (EPA-SAB-EEC-COM-00-001)

In response to the suggestion of the SAB Executive Committee, the Environmental Engineering Committee study of representative products over the past few years. The aim of the study was to develop persuasive, data-based arguments for enhancing technical reviews within the EEC and within the SAB in general.

Information was gathered by examining the impacts of eight reports of various types and discerning why some were effective and others were not. The findings were strengthened by interviewing 13 people having extensive knowledge of the SAB program and products; an additional 22 personal contacts were made concerning specific reports.

Findings and recommendations were developed in four aspects of the review process, including:

- a) Topic Selection and Charge
- b) Review Process
- c) Report Preparation
- d) Impact and Communication

**Key Words:** Retrospective Study, Improving Efficacy, SAB Reports, Communication , Impact, Feedback

**U.S. ENVIRONMENTAL PROTECTION AGENCY  
Science Advisory Board  
Environmental Engineering Committee (FY98-99)  
Retrospective Study**

**CHAIR**

**Dr. Ishwar P. Murarka** , ISH Inc., Cupertino, CA

**MEMBERS**

**Dr. Nina B. French** , Sky+, Oakland, CA

**Dr. Hilary I. Inyang** , University of Massachusetts, Lowell, MA

**CONSULTANTS**

**Mr. Richard Conway** , Union Carbide (retired), Charleston, WV

**Dr. Raymond C. Loehr** , The University of Texas, Austin, TX

**Dr. Frederick G. Pohland** , University of Pittsburgh, Pittsburgh, PA

**Dr. Calvin H. Ward** , Rice University, Houston, TX

**SCIENCE ADVISORY BOARD STAFF**

**Mrs. Kathleen W. Conway** , Designated Federal Officer  
Science Advisory Board (1400A), U.S. EPA, 401 M Street, S.W.,  
Washington, DC 20460

**Mrs. Mary M. Winston** , Management Assistant  
Science Advisory Board (1400A), U.S. EPA, 401 M Street, S.W.,  
Washington, DC 20460

**U.S. ENVIRONMENTAL PROTECTION AGENCY  
Science Advisory Board  
Environmental Engineering Committee (FY99)**

**CHAIR**

**Dr. Hilary I. Inyang** , University of Massachusetts, Lowell, MA

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Pittsburgh, PA

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**Dr. JoAnn Slama Lighty** , University of Utah, Salt Lake City, UT

**Dr. John P. Maney** , Environmental Measurements Assessment, Hamilton, MA

**Dr. Michael J. McFarland** , Utah State University, River Heights, UT

**Ms. Lynne M. Preslo** , Earth Tech, Long Beach, CA

**SCIENCE ADVISORY BOARD STAFF**

**Mrs. Kathleen W. Conway** , Designated Federal Officer  
Science Advisory Board (1400A), U.S. EPA, 401 M Street, S.W.,  
Washington, DC 20460

**Mrs. Mary M. Winston** , Management Assistant  
Science Advisory Board (1400A), U.S. EPA, 401 M Street, S.W.,  
Washington, DC 20460

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# 1. EXECUTIVE SUMMARY

Recognizing that the approaches to environmental protection at EPA are changing and that, to be most effective, the SAB needs to change with them, the Executive Committee held a retreat in November 1997. The resulting Science Advisory Board's 1997 Strategic Plan (EPA-SAB-98-010) was published in August 1998. The Executive Committee recommended that the Board spend much more of its total energies on providing strategic, forward looking advice, while maintaining and improving the quality, utility, and timeliness of its activities focused on Agency-requested peer review of EPA products.

Three individuals who have served as Environmental Engineering Committee chairs participated in the retreat. In early 1998, to support the recommendations, the Environmental Engineering Committee (EEC) formed a Retrospective Subcommittee to review that Committee's past activities and products and to develop from the outcomes an implementing strategy that might apply to the SAB as a whole. The Subcommittee was formed using both current and former EEC chairs and members.

The Subcommittee approached the charge by developing a body of information (data) from which findings and recommendations were derived. Thus, such findings and recommendations would be well-founded and persuasive. In developing the data base, the Subcommittee examined the impacts of eight reports of various types, discerned why some were more effective than others, and interviewed 13 people having extensive knowledge of the SAB programs and products. Subcommittee members contacted an additional 22 people for opinions concerning the impacts of specific reports.

Table 1 summarizes the outcomes and recommendations of the Subcommittee. Chapter 4 of the report presents the recommendations together with the findings upon which the recommendations were based. The Subcommittee submits the findings and recommendations to promote continued improvement in the conduct of the review activities of the SAB and its constituent committees.

**Table 1**

Outcomes and Recommendations for Improving the Efficacy of SAB Reviews and Reports

**A. Topic Selection and Charge**

1. The SAB should in most reviews look for issues broader than the charge, and appropriately address them in a constructive, supportive manner.
2. The SAB should, for most self-initiated studies, select them on the basis of their own experience and then further cultivate an interested/receptive clientele within the Agency before pursuing.
3. The SAB should screen proposed topics against criteria that include technical challenge and high value to the Agency. In other words, choose the topics for which the SAB advice has the high potential to make a difference.
4. The SAB staff should work with program personnel to develop more candidate reviews that are important and challenging.
5. The SAB should inform itself about planned Agency efforts and strive to become involved, when appropriate, at an early stage.

**B. Review Process**

1. The SAB should pay careful attention to the selection of chairs of Subcommittees. An ideal chair is committed and capable of producing the advice in a timely and useful manner. The SAB should also pay careful attention to selection of review committee members, using consultants more frequently to ensure the breadth of experience and productivity required to produce high-quality reports.
2. The SAB should ensure that scientifically diverging minority points of view are retained after full discussion and are not excluded from the reports.

**C. Report Completion**

1. Timeliness should be assured by developing a reasonable, agreed upon schedule between SAB and sponsor, adequate writing time immediately following the public meeting, preparation of drafts of the whole reports or sections by knowledgeable and committed Subcommittee members, and frequent exchanges of drafts and communication between chair, members and SAB staff.
2. The SAB should continue to communicate, as appropriate, with sponsors during all stages of a review, including providing consensus drafts of the report to the sponsors and other interested parties within the FACA process.
3. The likely effect of SAB recommendations on EPA programs should be postulated as a check on the way they are framed. An explicit discussion of the potential impacts of the recommendations should be encouraged.
4. When recommendations are numerous, varied, or complex, the SAB should simplify their presentation; categorizing the recommendations and setting priorities are useful ways to do this.

**D. Communication and Follow-up**

1. The SAB should first brief the sponsoring office between the last consensus draft and before final publication, and again engage in dialog with the sponsor after EPA receives the report and responds to it.
2. The SAB should follow-up important reports that are not acted upon to inquire "what is happening" and to encourage/support program initiatives in implementing SAB advice.

## 2. INTRODUCTION

At a retreat in November 1997, the SAB Executive Committee (EC) of the Science Advisory Board (SAB) considered how the SAB might effectively enhance the quality of science at EPA in the current era of environmental protection. Overall, the Executive Committee found that the SAB needs to provide more strategic, forward-thinking advice and more timely, high-quality peer review of selected topics.

To assist the EC in formulating strategies for improving SAB reviews, the Environmental Engineering Committee (EEC) formed a Retrospective Subcommittee to review the EEC's past activities and products, and to develop related recommendations for improvement. The Subcommittee was charged with determining the attributes of successful reviews (and problems with reports having lesser impacts) and recommending steps the EEC could take to increase the likelihood of completing reviews that have high value to the Agency. It was anticipated that many of these recommendations may apply to other SAB activities as well.

Current EEC members, past EEC Chairs, and leaders of important EEC studies served on the Subcommittee. The Subcommittee met twice in mid-1998, the first time to gather information and the second for analysis and writing. The Subcommittee recognized that the SAB had considered similar issues in the past. Some examples are:

- a) The 1989 report of the SAB Executive Committee's Mission and Functioning Subcommittee, chaired by Dr. W. Lowrance.
- b) EEC chair, Dr. Ishwar P. Murarka's July 12, 1994 letter to EC chair, Dr. Genevieve M. Matanoski, "SAB Self-study/Analysis of the EEC".
- c) The 1994 report of the Science Advisory Board's Reinvention Committee, *The Science Advisory Board: What's Next?* (EPA-SAB-EC-95-008).
- d) 1995 report of the Radiation Advisory Committee, *A Retrospective Review of SAB/RAC Activities*, (EPA-SAB-RAC-95-009).

The EEC's Retrospective Subcommittee aimed to develop new and more persuasive arguments for change within the EEC and other parts of the SAB. The Subcommittee plan reached its goals through:

- a) examination of the impacts of eight reports to develop data-based recommendations rather than opinions;

- b) strengthening these recommendations with information gained in interviews of program personnel and other knowledgeable people; and
- c) presentation of a comprehensive set of recommendations for change that can remind present and future SAB members of ways to improve impact .

### **3. DATA COLLECTED**

#### **3.1 Approach**

The Subcommittee used multiple approaches to develop recommendations to improve the effectiveness of SAB reviews. One approach consisted of selecting and critically evaluating eight prior EEC reports covering the full spectrum of perceived impacts on Agency actions; in the process of evaluating these reports, Subcommittee members spoke with 22 individuals knowledgeable about the individual reports. The Subcommittee examined these reports for topic origin, charge, subcommittee process, report content and communication, and impact on the Agency.

The Subcommittee also conducted telephone interviews and communications with 13 persons familiar with the SAB and its products, although not necessarily the eight reports evaluated in Appendix B. In addition, the Subcommittee and EEC discussed these interview issues with Agency staff at the July 22-24, 1998 EEC meeting.

#### **3.2 Data**

Table 2 lists the subjects of the eight EEC reports studied. Appendix A provides the full title and a synopsis for each report. The synopses are organized by the four evaluation elements (topic and charge, process, report and communication, impact). The analyses of these reports, supplemented by the telephone interviews, served as the basis for the findings and recommendations. The eight reports considered included two proactive commentaries, two research-in-progress evaluations, one program evaluation, and reports on three regulatory issues.

Table 3 provides the questions and respondents in the open-ended interviews. The Subcommittee interviewed 13 people having knowledge of the SAB products. Appendix B presents the interview questions and results.

The Subcommittee used the results of the report analyses, the interviews, and the discussions with Agency staff at the EEC's July 1998 meeting to establish the findings and recommendations presented in this report.

**Table 2**

**Subjects of EEC Reports Analyzed for Their Impact** <sup>1</sup>

- R1. Mathematical Models for Regulatory Assessment<sup>2</sup>
- R2. Peer Review in Regulatory Modeling
- R3. MMSOILS Model for RCRA Regulatory Impact Assessment
- R4. Technology and Commercialization Enhancement Program (EnTICE)
- R5. Incineration Research
- R6. Global Climate Change Research
- R7. Hazardous Waste Identification Rule
- R8. Leachability as Affects Contaminant Release <sup>2</sup>

<sup>1</sup>Full report titles are given in Appendix A

<sup>2</sup>Self-initiated study

**Table 3**  
**Questions and Respondents in Open-Ended Interviews**

Questions:

What SAB reports were useful to you or had an impact on the Agency actions?

What made these reports useful or made them have an impact?

Which SAB reports did you find not useful?

What made some SAB reports not useful?

Respondents:

**Donald G. Barnes** , Staff Director, Science Advisory Board

**Dorothy A. Canter** , Science Advisor, Office of Solid Waste and Emergency Response

**Donald Clay** , formerly of the Office of Toxic Substances and the Office of Air and Radiation

**Jeffrey Denitt** , formerly of the Office of Solid Waste

**Linda Greer** , Natural Resources Defense Council

**Clinton Hall** , Director, Subsurface Protection and Remediation Division, National Risk Management Research Laboratory, Office of Research and Development

**Penelope M. Hansen** , Director, Technology Coordination Staff, National Risk Management Research Laboratory, Office of Research and Development

**Robert Huggett** , formerly Assistant Administrator for Research and Development and former SAB Executive Committee member

**Walter W. Kovalick, Jr.** , Director, Technology Innovation Office, Office of Solid Waste and Emergency Response

**E. Timothy Oppelt** , Director, National Risk Management Research Laboratory

**Dorothy Patton** , Director, Office of Science Policy, Office of Research and Development and formerly of the Office of General Counsel

**Frank Princiotta** , Director, Director, Air Pollution Prevention and Control Division, National Risk Management Research Laboratory, Office of Research and Development

**Michael Shapiro** , Principal Deputy Assistant Administrator, Office of Solid Waste and Emergency Response

NOTE: Appendix A provides the names of those persons interviewed concerning specific reports

## 4. FINDINGS AND RECOMMENDATIONS FOR CHANGE

Based on the evaluation of the eight reports of various types (including 22 interviews), on the 13 telephone interviews, and discussion at a public meeting, the Subcommittee formulated the following findings and recommendations for its changes to improve the efficacy of EEC (and presumably SAB) reviews. The pertinent reports (R1-8 in Appendix A) and/or general telephone comments (Appendix B) are referenced after each finding. Recommendations follow each finding.

### 4.1 Topic Selection and Charge

**4.1.1** The Subcommittee finds that, even for reviews responding to a narrow Agency request, SAB reports can have wider more beneficial impact by proactively addressing broader issues in a constructive, supportive manner (R2, interviews). Therefore, in most reviews, the SAB should look for issues broader than the charge, and then appropriately address them in a constructive and supportive manner.

**4.1.2** The Subcommittee finds that self-initiated studies (commentaries and resolutions) are most worthwhile when:

- a) based on broad experience of the SAB;
- b) an interested/receptive clientele can be identified or developed; and
- c) they address situations that the Agency should change from a science perspective, can change from a regulatory perspective, and will consider changing from a policy perspective. (R1 did that; R8 evidently did not).

Therefore, the Subcommittee recommends that, when selecting self-initiated studies, the SAB should

- a) select issues that appear important based on the personal experience of the Committee members; and
- b) cultivate an interested/receptive clientele within the Agency before pursuing the initiative.

**4.1.3** The Subcommittee finds that the SAB contributes best when a topic is significant in terms of:

- a) impact on the Agency;
- b) the degree of contentiousness;
- c) extent of technical challenge; and
- d) importance to top management (R5,6 and interviews).

Therefore, the SAB should screen proposed topics against criteria that include technical challenge and high value to the Agency. In other words, the SAB should give

priority to activities where its advice has a high probability of making a positive difference. A transparent screening process should be employed using objective criteria. Also, the SAB staff should work with program personnel to develop more requests for reviews that are important, timely and challenging.

**4.1.4** The Subcommittee finds that SAB reports have both more immediate and less disruptive impact when the SAB is involved at an early stage of a regulatory effort (R2), rather than after completion of an effort (R3,7). Therefore, the Subcommittee recommends that the SAB committee chairs and/or DFO inform themselves about Agency activities, both regulatory and non-regulatory, and strive to seek SAB involvement, when appropriate, at an early stage.

## **4.2 Committee Review Process**

**4.2.1** The Subcommittee finds that a SAB Committee more frequently produces a high-quality review, on time, when a knowledgeable, hard-working chair either drafts the majority of the report or leads the committee to draft sections of a report (R1,2,5 and interviews). Therefore, the Subcommittee recommends that the SAB select Subcommittee chairs who are committed to and capable of leading the production of a report in a timely and useful manner. The SAB should also pay more attention to the selection of reviewers, using consultants more frequently to ensure the breadth of experience and expertise required to produce high-quality reports.

**4.2.2** The Subcommittee finds that consensus reports are desirable and that minority views should be included (interviews). Therefore, the SAB should ensure that scientifically diverging opinions are retained after full discussion and are not excluded from the reports if consensus is not reached.

## **4.3 Report Completion**

**4.3.1** The Subcommittee finds that timeliness and technical content determine whether a SAB report is useful (R 2,4,5,6 and interviews). Therefore, the Subcommittee recommends that timeliness should be assured by:

- a) developing a reasonable, agreed upon schedule between the SAB and sponsor;
- b) providing adequate writing time immediately following the public meeting;
- c) drafting the entire report or sections by one or more knowledgeable and highly committed Subcommittee members; and
- d) frequently exchanging drafts and communication between chair, members and SAB staff.

**4.3.2** Within the structure developed by FACA, the Subcommittee finds that communication with the sponsor at all stages of the review and report drafting results in higher impact (R2,5,8 and interviews). Therefore, the Subcommittee recommends that the SAB continue to communicate, as appropriate, with sponsors during all stages of a review, including providing consensus drafts of the report to the sponsors and other interested parties within the FACA process.

**4.3.3** The Subcommittee finds that inappropriately critical SAB reports can set EPA programs back for several years (R3,7); also, if the SAB's recommendations are too broadly written, they can be impossible to implement (R8). Therefore, the Subcommittee recommends that review panels postulate some likely effects of the draft recommendations on EPA programs to determine whether they are written to achieve the intended impact. This process will also serve as a check on the way the recommendations are framed.

**4.3.4** The Subcommittee finds that the impact of individual recommendations is diminished when there are too many recommendations that are not organized. Priority, topic, and timing are often useful ways of organizing the recommendations. Therefore, the Subcommittee recommends that, when recommendations are numerous, varied, or complex, the SAB should organize its recommendations in a manner useful to the intended audience.

#### **4.4 Communication and Follow-up**

**4.4.1** The Subcommittee finds that some reports do not receive the attention of higher level program officials (interviews). Therefore, the SAB should engage in dialog with the sponsoring office between the last consensus draft and final publication, and then again brief the sponsor and AA (if needed) after EPA receives the report and responds to it.

**4.4.2** The Subcommittee finds that some important SAB reports may lie dormant, even with Agency supporters, for five to ten years before having a major impact (R2,6,8 and interviews). Therefore, the SAB should periodically follow-up on important reports that are not acted upon in order to inquire "what is happening" and to encourage/support program initiatives that implement SAB advice.

## **APPENDIX A**

### **Synopses of Representative Reports**

#### **1. Resolution On the Use of Mathematical Models by EPA for Regulatory Assessment and Decision-Making (EPA-SAB-EEC-89-012)**

##### Topic Choice and Charge

This report was a self-initiated resolution. This resolution on the use of mathematical modeling for regulatory assessment and decision-making grew out of the EEC's experience reviewing modeling studies by several EPA offices. The Committee noted that certain problems were common to the various modeling efforts and believed that these common problems would be best called to the Agency's attention through a more general resolution on modeling.

##### Subcommittee Review Process

The Chairman of the Subcommittee took the lead in preparing the resolution. Drafts of the resolution were presented and widely discussed at a series of Committee and Executive Committee meetings during 1988.

##### Report and Communication

The seven-page resolution on the use of mathematical models offered eight main points on seeking better balance between field and laboratory data; obtaining confirmation of models; establishing an Agency-wide task group to assess and guide model use; and conducting peer review at various levels. Since the submission of the modeling resolution, the SAB has transmitted several additional SAB reviews and commentaries on modeling to various offices of the Agency.

The SAB transmitted the modeling resolution to Administrator Lee M. Thomas on January 13, 1989. No record of an official response to the SAB resolution is available. The proponents of the resolution hoped that by drawing this persistent problem to the Administrator's attention, specific work, such as development of validated environmental assessment models with integral uncertainty analysis capability would be undertaken and that these models would be well-documented, peer-reviewed implementations with software, capable of producing uncertainty-bounded best estimates for a range of increasingly detailed input data.

The concerns captured in the resolution also arose in other SAB committees during reviews dating back to the early 1980s. The Radiation Advisory Committee cited the June 1988 draft resolution in its review of the technical basis for the

Radionuclides NESHAP (EPA-SAB-RAC-89-003). In 1992, the Radiation Advisory Committee submitted a separate commentary on the status of EPA Radionuclide Models (EPA-SAB-RAC-COM-92-001), reiterating many of the recommendations contained in the 1989 modeling resolution. More recently, the Environmental Economics Advisory Committee has cited the resolution in its Commentary on Peer Review of Research Used in Support of Environmental Policy (EPA-SAB-EEAC-COM-94-003).

### Impact Assessment

Conversations with EPA personnel, including Dorothy Canter, Gary Foley, Rosemary Russo, and Dave Brown, together with the review of published materials from EPA, confirm that the modeling resolution had and continues to have major positive impacts. One result was that in March 1992, then Deputy Administrator F. Henry Habicht created an *ad hoc* Agency Task Force on Environmental Regulatory Modeling (ATFERM).

The Task Force was given 12 months to recommend specific actions EPA should take to improve model development and their use in policy, regulatory assessment and decision-making. ATFERM's conclusions and recommendations for improvement to ensure the scientific integrity of the use of models were published in a guidance document in March 1994 (EPA-500-R-94-001).

AFTERM also produced a draft "Agency Guidance for Conducting Peer Review of Environmental Regulatory Modeling" in 1993 which was then reviewed by the EEC (EPA-SAB-EEC-LTR-93-008). The EEC review led to important additions and refinements to guidance as indicated in the response by Administrator Carol Browner on January 31, 1994.

In June 1994, the Administrator promulgated a peer review policy to reconfirm and expand EPA's commitment to peer review scientific and technical work products used in Agency decision-making. In January 1998, a Peer-Review Handbook (EPA-B-98-001) was completed to complement 1994 Policy and to assist the Agency in meeting its goal of enhancing the quality and credibility of Agency decisions.

In November 1997, EPA held a Models-2000 workshop to develop recommendations for a Models Implementation and Improvement Plan for enhancing modeling within EPA. In January 1998, the Agency established a Committee on Regulatory Environmental Modeling (CREM) to promote consensus within the Agency on mathematical modeling issues. Correspondingly, the Executive Committee (EC) formed the Environmental Models Subcommittee to help the Agency in this endeavor. Overall, the consensus response of the Agency personnel and the actions undertaken within the Agency allude to a positive impact of the SAB modeling resolution.

## **2. Review of Draft Agency Guidance for Conducting External Peer Review of Environmental Regulatory Modeling (EPA-SAB-EEC-LTR-93-008)**

### Topic Choice and Charge

The *ad hoc* Agency Task Force on Environmental Regulatory Modeling (AFTERM), created by the Risk Assessment Council, asked the EEC to review its "peer review guidance", one of AFTERM's first products to support better management of model development and application. At the same time, the EPA's Council of Science Advisors (CSA) began preparation of an Agency Policy on Peer Review. Recognizing the early stage of both programs, the EEC decided to address the AFTERM's modeling peer review guidance and modeling issues in the Agency Policy on Peer Review. The EEC also provided some general advice on the peer review process. Incidentally the AFTERM report was developed in response to the EEC's "Resolution on the Use of Mathematical Models by EPA for Regulatory Assessment and Decision Making" (EPA-SAB-EEC-89-012).

### Subcommittee Process

The AFTERM draft EPA Peer Review Guidance for Regulatory Modeling was dated January 26, 1993. The eight-person Subcommittee assembled to review this Guidance met on March 3-4, 1993 and issued its report on July 8, 1993. Consensus drafts were provided earlier. Keeping the period between initial meeting and report issuance short required close coordination and frequent communication between Chair, committee, and staff.

### Subcommittee Report

The concise eight-page letter report both supported the AFTERM program and recommended important improvements. These changes were constructively phrased, as were the cautions included in the letter report. Some issues addressed regarding the peer review process were criteria, review elements, documentation, and closure. The report was proactive, going well beyond model review to address AFTERM continuance past its planned 12-month life, the peer review of model applications (regulatory decision making) as well as model development, and the misuse of default values. Many of the recommendations, e.g., documentation and closure, were thought to be applicable to the fledgling Agency's Policy on Peer Review.

### Impact Assessment

The January 31, 1994, response from the Administrator to this report included both a point-by-point response to the Subcommittee's comments and a revised draft Guidance incorporating many changes made in response to the SAB review. The

Council of Science Advisors endorsed the response; this endorsement helped insure the comments were considered in formulating the broad Agency Policy on Peer Review. Finally, after the *ad hoc* AFTERM completed its assignment, the Administrator decided EPA should continue coordination efforts on modeling and also required peer review for certain models that would be used in regulatory decisions.

Office of Science Policy (OSP) staff have kept alive the "guidance for peer review of models" since 1993. However, it has been dormant, until recently. Reportedly, the guidance is being incorporated into the current Models 2000 program. According to Dr. Dorothy Patton, it had been "redelivered" by program personnel (albeit without further SAB input) to OSP many times through the interim 5 years.

Administrator Reilly issued the Agency Peer Review Policy by the end of his term (19 January 1993). Administrator Browner re-issued the Policy in 1994. In February 1998, the SPC issued a "Handbook on Peer Review" ; the handbook includes detailed requirements in documentation, closure, and other elements recognized in the EEC's July 1993 report.

### **3. Review of MMSOILS Component of Proposed Regulatory Impact Analysis (RIA) for the RCRA Corrective Action Rule (EPA-SAB-EEC-94-002)**

#### Topic Choice and Charge

This report by the MMSOILS Model Review Subcommittee (MMRS) was prepared as part of the SAB's review of the "Draft Regulatory Impact Analysis for the Final Rulemaking on Corrective Action for Solid Waste Management Units: Proposed Method for Analysis". This report was one of six reports reviewing different aspects of OSWER's RCRA/RIA corrective action cost/benefit analysis and its application. The focus of the review was the Agency's draft document entitled "MMSOILS: Multimedia Contaminant Fate, Transport and Exposure Model Documentation and User's Manual" dated September 1992.

The Agency, through the Office of Solid Waste and Emergency Response, asked the SAB to review specific elements of the multi-media contaminant fate, transport and exposure model MMSOILS, with regard to the methodology used to predict contaminant concentrations in the environment and the resultant implications on human health and ecological risk assessments. Specifically, the review dealt with:

- a. the adequacy of methods for using a screening level model where there is substantial subsurface heterogeneity and/or where nonaqueous phase liquids (NAPLs) are present,;

- b. the appropriateness of the Agency's approach for aggregating releases from solid waste management units (SWMUs) in order to estimate concentrations at exposure points as a function of time; and
- c. the adequacy of the Agency's approach for developing long-term effectiveness and failure scenarios for site remedies.

### Committee Review Process

The MMRS held public reviews on June 22, 23, and 24, 1993. The MMSOILS document that was the subject of this review was developed jointly by the Office of Research and Development's (ORD), Office of Health and Environmental Assessment (OHEA), Exposure Assessment Group (EAG), and the Office of Environmental Processes and Effects Research (OEPER). A broad cross-section of EPA personnel from these offices made presentations to the Committee. The SAB report was prepared by the MMRS during subsequent writing periods.

### Report and Communication

In brief, the EEC's MMSOILS report found that:

- a. the interagency coordination represented by the whole RIA effort was a "model approach" and should be adopted in other programs;
- b. MMSOILS addressed all major contaminant pathways and was computationally efficient; and
- c. MMSOILS might be a valid screening tool, when applied to simplified cases, for assessing the relative risks and costs associated with alternative regulatory options.

However, the Committee identified two unquantifiable uncertainties that seriously diminished the utility of MMSOILS relative to its use in the draft Corrective Action Regulatory Impact Analysis (RIA), namely :

- a. inadequate and inaccurate input parameters resulting from sparse or inaccurate information, poor parameter estimation, especially relative to source terms, and suspected over-reliance upon default parameters; and
- b. application of the model to cases outside its range of validity, such as sites with complex hydrogeological conditions or sites where NAPLs are present.

Considering the uncertainties, the Committee concluded that MMSOILS output could be wrong by several orders of magnitude at complex sites. The Committee gave numerous specific recommendations for augmentation of the RIA modeling and for obtaining cost/benefit estimates derived from alternative approaches. Expert peer review was found to be a general need for most aspects of MMSOILS use for RIA.

The MMSOILS report was submitted by the SAB to Administrator Carol Browner on November 19, 1993. The SAB received a response to all six of the RIA reports from the Administrator on March 21, 1994. The response was in the form of a table summarizing the issues raised by the MMRS and its recommendations, and the status of Agency activities to address the recommendations. Significant activity was underway in response to the report, and all recommendations were being addressed in a positive manner.

#### Impact Assessment

Based on interviews with Agency personnel, including Barnes Johnson, David Brown, Larry Reed, and Elizabeth Cotsworth, the Agency response to the MMSOILS report was immediate and positive. The Agency was working under a congressionally mandated deadline to perform a regulatory impact analysis for RCRA. Hence, the MMSOILS report was topically important and timely. However, EPA staff involved in preparing the Agency's draft document on use of MMSOILS were naturally disappointed by the lack of endorsement of their report by the SAB, but appreciated the counsel. Many of the MMRS recommendations required additional effort with long lead times which could not be accomplished within the deadline for Agency response. Some EPA staff felt the MMRS did not recognize the effort involved in preparing the draft report and that the Committee had been too critical of the Agency's efforts. Corrective action on solid waste management units has not been submitted to Congress by the Agency. One lesson seems to be earlier involvement by the SAB through either consultation or a two-stage review.

#### **4. EPA's Environmental Technology Innovation and Commercialization Enhancement Program (EnTICE) (EPA-SAB-EEC-95-016)**

##### Topic Choice and Charge

The Office of Environmental Engineering and Technology Demonstration (OEETD) in the EPA Office of Research and Development (ORD) requested this review, which was performed by the Innovative Technology Subcommittee of the Science Advisory Board's Environmental Engineering Committee.

The charge was to review a proposed strategy of establishing third-party centers, temporarily supported by EPA, to generate credible data and information for the market place and permitting arenas; the information was intended to help decision-makers promote the use of innovative technologies in a more informed and confident manner. Primary issues focused on costs and early self-sufficiency of verification centers, EPA imprimatur and oversight, accountability and measures of success. Secondary issues focused on the stakeholders, barriers and incentives, verification protocols, pollution prevention, technology categories and priorities, and state permitting and reciprocity.

### Subcommittee Review Process

The six-person Subcommittee received and OEETD white paper describing EnTICE and options for structuring, as well as the written charge, and met on May 2-3, 1995 with briefings by and to EPA personnel. The Subcommittee report was prepared during the subsequent writing periods.

### Report and Communication

The 18-page report on the EnTICE review specifically addressed each issue accompanying the initial charge to the Subcommittee. Major findings and recommendations were, in brief: recognition of an opportunity for EPA to provide leadership in addressing technological development and U.S. competitiveness, enhanced by a successful technology verification programs; the need for development of third-party verification with protocols, EPA support and oversight, and parallel programs addressing critical issues, impeding alternative technology infusion into the marketplace; the need for re-assessment and use of pilot programs where success made a difference in technology acceptance; and the need for vivid recognition of the total stakeholder community; the need for facilitation of technology permitting and reciprocal use and communication of data and information.

The EnTICE review report was submitted to Administrator Carol Browner on August 25, 1995. Although there is no record of an official response to the report, Administrator Browner's response to a companion report issued the same day indicates the Agency's intent to move ahead "vigorously" on these issues, consistent with SAB findings and recommendations. The companion report is the Hazardous Air Pollutant (HAP) Monitoring Subcommittee's *Review on Verification of Innovative Continuous Air Emission Monitors* (EPA-SAB-EEC-95-018). The EEC's HAP Monitoring Subcommittee report reviewed projects proposed under EnTICE and then commented more broadly upon technology development and commercialization issues. The EnTICE and HAP efforts resulted from the January, 1994, draft *Technology Innovation Strategy* (EPA 543-K-93-002) prepared by EPA's Innovative Technology Council (ITC).

The associated EEC report is, *EPA's draft Technology Innovation Strategy* (EPA-SAB-EEC-95-013).

### Impact Assessment

Interviews with EPA personnel indicate that the EnTICE review had immediate and positive effects on the verification strategy then under development. This is most evident in technology verification. Those interviewed included Penelope Hansen, Director, Environmental Technology Verification Program; E. Timothy Oppelt, Director, National Risk Management Research Laboratory; and Walter Kovalick, Director, Technology Innovation Office.

Indeed, the growth of the EPA Environmental Technology Verification (ETV) Program highlights without question and with specific reference to the EnTICE review (pages 5-6) the effectiveness of the review process in stimulating action and providing effective guidance. The Verification Strategy (EPA/600/K-96/003) articulates the goals, operating principles and future plans for the ETV. This strategy has been endorsed by EPA Administrator Browner by correspondence to Vice President Gore and to chairs and ranking minority members of various Congressional committees.

As of April 1998, two ETV pilots had verified twelve technologies. The resulting verification statements document and communicate the findings. EPA expects to verify approximately 300 innovative technologies within the first decade of the ETV program. A Quality Control and Management Plan for the Pilot Period (1995-2000) has been prepared and published (EPA/600/R-98/064). Again the SAB input was acknowledged. Overall the consensus response by EPA personnel to the impact assessment was positive.

## **5. Review of the Waste Incineration Research Program (EPA-SAB-EEC-96-004)**

### Topic Choice and Charge

ORD requested that the EEC review their ongoing waste incineration program at the National Risk Management Research Laboratory, Air Pollution Prevention and Control Division, Research Triangle Park, North Carolina. The charge included a review of future issues identified, such as Products of Incomplete Combustion (PICs), program integration between past and future work, and effectiveness of in-house research to meet short-term and long-term agency needs.

### Subcommittee Review Process

The review took place in September 1995 at the RTP facility. Senior ORD research staff briefed the Subcommittee on each of the main program areas. Copies of all presentation material and other background materials were provided. The Subcommittee was well-balanced with combustion and environmental experts, many with years of experience in this area. The chair provided an oral summary of the Subcommittee's findings to the EPA management, technical staff, and others present during the last day of the review. Although a report was outlined at the meeting, writing assignments were not completed during the review meeting. Difficulties with EPA's FY96 budget, including repeated continuing resolutions and a month-long furlough of Agency staff, interrupted the normal report preparation sequence. The report was approved by the EEC in May 1996, by the EC in June 1996, and finally issued nearly one year after the review, in August 1996.

### Report and Communication

The review found that the program was focused on very important issues to the Agency, and that more funding should be provided to the laboratory to allow it to build core competency. Recommendations included collaboration with other research institutions, and the need to keep combustion in the Agency's core research despite public perception of difficulties with combustion-related technologies such as incineration. The Subcommittee sensed that because of opposition to combustion-related systems, EPA was neglecting this research area, even though combustion is an important activity within our society. In her May 1998 response, the Administrator stated that the Agency agreed with all findings and recommendations in the SAB report.

### Impact Assessment

Based on telephone discussion with Frank Princiotta, the report had an impact in one main area: the Combustion Branch developed a formal strategic plan. However, the priorities of the entire organization have changed dramatically since the review was conducted, based largely on new priorities from the Administrator (e.g., mercury).

## **6. Review of the Global Climate Change Engineering Research and Development (R&D) Program (EPA-SAB-EEC-LTR-93-013)**

### Topic Choice and Charge

The EPA Office of Research and Development requested SAB review of its April 1993 draft report on Global Climate Change Engineering Research and Development Program (GCERDP). This program is managed by the ORD's Air and Energy Engineering Research Laboratory (AEERL), Research Triangle Park, North Carolina.

The report contained background information on key topical areas such as greenhouse gas emissions estimation/database management, methane migration research, and biomass utilization research, as well as possible direction for future programs should significantly greater resources become available. Specifically, the review dealt with strategic and tactical issues concerning rational and scientific soundness of approach, rigor and practicality, project selection, proposed expansion, significance of concentration, and request for guidance.

### Subcommittee Review Process

The 10-member Global Climate Change Engineering Research Subcommittee (GCCERS) met publicly May 26-27, 1993 at the EPA AEERL. The Subcommittee included members of the EEC, consultants previously involved with global climate change research, and others who had contributed to the SAB's review of EPA's Report to Congress on Potential Effects of Global Climate Change on the United States (EPA-SAB-EC-89-016). Both draft and final reports were prepared during subsequent writing periods.

### Report and Communication

The Subcommittee report found that the existing GCCERDP was rational, scientifically sound and rigorous, with a reasonable and practical selection of projects. It endorsed the focus on identification and characterization of key anthropogenic sources of methane and source control by engineering solutions. It also made recommendation for further development of the Global Emissions Data Base (GloED), with a focus on the needs of potential users and more attention to definition of data quality and uncertainty. Similarly, the need to gather and disseminate information on potential technologies for recovery and use of methane with interagency collaboration was stressed, along with attention to waste management facilities, biomass conversion, transportation fuels, and global emissions of tropospheric ozone depleting precursors.

The Subcommittee's review of GCERDP was submitted as a letter report to Administrator Carol Browner on August 12, 1993. Administrator Browner responded on December 10, 1993 with a point-by-point response prepared by the Office of Research and Development, and an expression of appreciation which extended an invitation to conduct future scientific reviews on selected programs. It also acknowledged that the needs and opportunities for research and development in this and other areas would far outstrip EPA financial resources for the foreseeable future, and that "difficult but unavoidable choices" would need to be made.

### Impact Assessment

Based upon interviews with EPA personnel, including Frank Princiotta, Director, AEERL at the time of the review, E. Timothy Oppelt, Director, National Risk Management Research Laboratory, and Susan A. Thorneloe, Senior Project Officer, Atmospheric Protection Branch, some progress has been made toward addressing the continuance of the global climate research initiative, but largely in activities already in effect. The growth and expansion into other areas appears to have been curtailed by budgetary constraints and a change in priorities, hence the impacts of the SAB review are not readily evident.

This outcome has been presented in a detailed follow-up on EPA's Global Climate Change Program by Frank Princiotta, Director, Air Pollution Prevention and Control Division at Research Triangle Park (1998) which systematically outlines the Agency response to recommendations in the original SAB report. Both declining budgets and change in program focus were cited as limitations to implementing SAB recommendations. Pollution control infrastructure assessment, development of in-house software for mitigation assessment, and alternatives to HFCs in supermarkets are now emphasized.

However, The President has attempted to focus Congressional attention on an enhanced program with greatly improved funding throughout the various federal agencies, including EPA; this is the Global Climate Technology Initiative (President Clinton, October 22, 1997). The November 1998 STAR Grants RFA lists Integrated Assessments of the Consequences of Climate Change as a priority area. If resources or priorities change, EPA could revitalize its global climate change initiative using the SAB letter report guidance as a logical basis for action. Hence, although global climate research in the Agency appears somewhat dormant at the moment, an executive mandate with concomitant funding could provide EPA a window of opportunity for resumption of its original agenda.

## **7. Review of a Methodology for Establishing Human Health and Ecologically Based Exit Criteria for the Hazardous Waste Identification Rule (HWIR) (EPA-SAB-EC-96-002)**

### Topic Choice and Charge

The Office of Solid Waste (OSW) requested a SAB review of the March 1995 draft, "Development of Human Health and Ecologically Based Exit Criteria for the Hazardous Waste Identification Project". OSW prepared this document to support the Hazardous Waste Identification Rule (HWIR). The intent of the HWIR is to establish human health-based and ecologically-based waste constituent concentrations (exit criteria) for constituents in wastes below which listed hazardous wastes would be

reclassified and become delisted and non-hazardous wastes under the Resource Conservation and Recovery Act (RCRA).

The draft HWIR document described a proposed methodology for calculating exit concentrations of 192 chemicals for humans and approximately 50 chemicals for ecological receptors, based on a consideration of five types of waste management units; numerous release, transport and exposure pathways; and biological effect information.

The charge to the Subcommittee contained 17 specific questions about the proposed methodology. After discussing the charge, the Subcommittee agreed to focus on the larger issues because a detailed peer review of each of the individual equations, parameters or assumptions was beyond the resources and time available to the Subcommittee. However, summary responses to the charge questions are included in the Subcommittee Report.

#### Subcommittee Review Process

After receiving the draft methodology and the charge, the 11-person Subcommittee met publicly in Washington, DC on April 26-27 and May 30 - June 1, 1995. The Subcommittee heard presentations from the Agency, its contractors, and members of the public regarding the proposed methodology for calculating exit criteria. In addition to reviewing the proposed methodology, the Subcommittee requested and reviewed sample calculations for two chemicals in order to evaluate the implementation of the total methodology. The Subcommittee report was prepared during the subsequent writing periods.

#### Report and Communication

The 30-page report of the HWIR Methodology review addressed each charge with focus primarily on the larger issues. The Subcommittee concluded that the proposed methodology has a number of critical flaws that must be corrected in order to develop scientifically defensible exit criteria. The Subcommittee recommended that the proposed method of calculating exit criteria, which considers individually each exposure pathway, be abandoned in favor of true multi-pathway calculations in which a receptor concurrently receives contaminants from a source via all pathways. In addition, the Subcommittee urged the Agency to: conduct substantial validation and peer review of the overall methodology; provide a systematic examination of parameters and uncertainties; calculate ecologically-based exit criteria for those chemicals for which a minimum data set is available; and rewrite the documentation for clarity and transparency. The Subcommittee estimated that a concerted effort to correct the major flaws in the methodology could be completed within a relatively short

time, perhaps a year or two, if a concerted effort is instituted with the appropriate scientific involvement.

The HWIR Methodology review report was submitted to the Administrator Carol Browner on May 23, 1996. The official response to the report from Administrator Browner was sent on August 29, 1996. Two separate follow-on communications were made to clarify the major aspects of the SAB Advice. In a telephone conversation between Mr. Mike Shapiro (OSW Office Director), Dr. Mark Harwell (Subcommittee cochair) and Dr. Donald Barnes (SAB Staff Director), the major conclusion that the methodology lacked scientific defensibility for its intended regulatory use and that an adequate scientific basis might be developed with a concerted effort was clearly emphasized. In a face-to-face meeting between Mr. Mike Shapiro, Dr. Donald Barnes and Dr. Ishwar Murarka (Subcommittee Cochair) further discussions of the SAB comments occurred.

The written response from the Administrator acknowledged that SAB review had raised significant issues and that the OSWER and ORD were working together to develop a strategy to address the SAB comments and fulfill the Agency's statutory obligations within a reasonable time frame. The response further stated that once such a strategy is developed, the Agency would be interested in meeting with the SAB to discuss the proposed approach.

## Impact Assessment

Based upon conversations with EPA personnel, including Barnes Johnson, Rosemary Russo, Jim Brown and Mike Shapiro, it is clear that the SAB review had a major impact on the Agency -- the Agency took the SAB advice to obtain an extension of approximately five years from the U.S. Circuit Court for promulgating the HWIR, specifically citing the SAB report.

After obtaining the extension, the Agency assembled a team of experts from the OSWER and the ORD to address the technical issues raised in the SAB review. A detailed plan has been prepared by the Agency to describe how the new/ revised HWIR methodology is being developed, verified and will be applied to obtain the risk-based exit criteria for the HWIR. The Agency has commissioned a blue ribbon panel to peer-review the plans for the revised methodology. The SAB report has been extensively used in formulating the plans for revising the HWIR methodology. Overall, the general response from the Agency to the question of impact was that the SAB review did raise significant issues which are being resolved in the revised methodology to the extent possible within the deadline imposed by the court.

### **8. Leachability: Recommendations and Rationale for Analysis of Contaminant Release (EPA-SAB-EEC-92-003)**

#### Topic Choice and Charge

Over a decade (1981-91), the Environmental Engineering Committee (EEC) of the Science Advisory Board (SAB) reviewed a number of EPA subjects and issues involving Leachability phenomena, either as a major or minor factor in the review. In these various reviews, the Committee noted a number of problems and issues relating to Leachability phenomena that were common to a variety of programs, rules, and Agency procedures. The Committee believed that these common problems and issues would be best called to the Agency's attention through a general set of recommendations on Leachability phenomena rather than in the specific individual reviews.

Believing that the scientific principles of contaminant Leachability need broader understanding and exposition, the EEC undertook the initiative, with the concurrence of the SAB Executive Committee, to conduct a self-initiated review to:

- a. Consider the fundamental scientific principles that can reliably describe contaminant release/transport, and, in particular, to consider the

controlling characteristics of the source, the leaching media and the importance of dynamic considerations; and

- b. Suggest how the scientific principles can be applied to determine how a waste will leach when present in the environment, according to a prescribed scenario.

### Subcommittee Review Process

The Leachability Subcommittee (L.S.) was formed by the EEC and had 13 members. The group convened a project scoping and planning session in Houston, Texas on December 15-16, 1989 immediately following a Workshop related to this topic. The L.S. then followed this with a one-day session in Washington DC on February 26, 1990, which was devoted to assessing the Agency's varied needs for Leachability-related information. The day's activities and findings were then discussed with the full EEC on February 27, 1990. This was followed by a Workshop on Leachability on May 9, 1990 in Washington DC. The Workshop was conceived as a vehicle for distinguished scientists, engineers, and practitioners in the field to focus on the scientific principles and issues relating to Leachability phenomena. The Workshop was video taped, so that those unable to attend from EPA, or any other interested parties, could have the benefit of this exchange of information.

The Leachability Workshop assisted the L.S. of the SAB's EEC to better define the fundamental scientific principles that control Leachability. Further, the workshop assisted the SAB and the attendees in ascertaining how Leachability phenomena and tests can be applied on an appropriate and consistent basis to determine how a waste will leach when present under various scenarios in the environment.

This SAB self-initiated study to provide the Agency general and broad-based guidance on release of contaminants from sources spanned a period of 18 months from initiation to transmittal of the report to the Administrator.

### Report and Communication

The Leachability report recommended an Agency-wide effort to:

- a. study and better understand the mechanisms controlling Leachability;
- b. develop better conceptual models for waste management scenarios;
- c. evaluate stresses affecting long-term contaminant release potential;

- d. develop a variety of contaminant release tests and test conditions to assess potential release of contaminants from sources of concern;
- e. improve mathematical models to complement laboratory tests, and
- f. field-validate leach tests before being broadly applied.

The Leachability Subcommittee sensed that improving the state-of-the-art of quantitatively predicting the rate of contaminant release from sources should be a high priority of the Agency. Hence, the Subcommittee recommended establishment of an inter-office, inter-disciplinary task group, including ORD, to help implement their recommendations and devise an Agency-wide protocol for evaluating release scenarios, tests, procedures, and their applications. The Subcommittee also called for increased core research on contaminant release and transport within the waste matrix.

The Leachability report was submitted by the SAB to Administrator William Reilly on October 29, 1991. The SAB received a response to the report from the Administrator on March 2, 1992. Each of the nine recommendations was favorably addressed, and specific examples were given of ongoing Agency activities in response to the recommendations. However, no commitment was made to establish an inter-office task group to implement the recommendations. Rather, the issue was referred to the Environmental Monitoring and Management Council, which is charged with, among other things, improving the coordination of EPA's methods development program to avoid duplication and to avoid inconsistencies in quality assurance and quality control guidelines. No further response to the Leachability Report was received by the SAB.

### Impact Assessment

Based upon interviews with the EPA personnel, including Gail Hansen and Greg Helms both of OSWER, the impacts of the SAB recommendation on Leachability are somewhat limited. The Agency staff agrees with most of the recommendations contained in the SAB review. They acknowledge that this SAB report has been widely distributed within the Agency and is often used as a scientific reference document. In 1998, EPA began to use the SAB report more as it became active in addressing regulatory issues on leaching test. In 1998, the Agency completed a technical report to update some of the contents of the SAB report, particularly the aspects relating to leaching of contaminants from oily wastes. Overall, the Agency staff acknowledges that the report is valuable to them, but the SAB recommendations have only been utilized in a limited fashion.

The topic remains important. In 1999, the EEC submitted a commentary to the Agency entitled, "Waste Leachability: The Need for Review of Current Agency Procedures" (EPA-SAB-EEC-COM-99-002). OSWER convened a public meeting July

23-24, 1999, to define directions for modifying and/or developing leaching test methods to meet the multiple needs in the Agency's programs.

## **APPENDIX B**

### **Summary of Data from the General Telephone Interviews**

The interviewees deemed the following attributes as those that make an SAB review successful.

#### **Topic Choice and Charge**

The SAB contributes best when the topic is significant, contentious, technically challenging, and important to top management.

The SAB contributes best when the topic is primarily scientific, not political or primarily policy.

The SAB should match the type of review to the life cycle of the topic.

The SAB works best when the scope of the topic is well defined and can be grasped by the subcommittee, or is tiered from simple to complex, if necessary.

The SAB should go beyond the charge, when appropriate, to get to the heart of the issue.

#### **Committee Review Process**

The SAB works best when the review group is composed of members who are prepared to provide appropriate scientific opinions.

The SAB contributes most when it achieves consensus; however, the SAB contributes even when it does not achieve consensus if the differing views are clearly presented in the report.

The SAB works best when both the review group (when in session) and Designated Federal Official (DFO) maintain clear communications with the Agency sponsor.

The process works best when the sponsor's requirements, including timeliness, are clearly defined at the beginning of the review.

#### **Report Preparation Process**

The SAB should provide verbal debriefings to the sponsor at the end of public meetings.

The SAB should share drafts of report with sponsors (and other stakeholders) as early as possible while still meeting all FACA requirements.

To improve the timeliness of the final report, the SAB should write draft sections or, at a minimum, detailed outlines before leaving the review; if necessary, a writing day should be scheduled.

The SAB reports should be forthright about what is agreed, and what is known.

The SAB reports should treat the Agency professionally and consider in context what the Agency can and cannot do.

The SAB reports that contain constructive criticism can shorten response time by following up with sponsor.

It would be helpful if the SAB prioritizes recommendations to help EPA decide what to focus on first.

The SAB should try to reach consensus; if consensus cannot be reached, then the final report should clearly say so.

### **Final Report and Communication**

The SAB should brief the EPA sponsoring office on findings after the report is approved and before it is published.

The SAB report and findings should be available to sponsoring organizations within expected time lines.

The SAB chair should follow up with sponsor, especially when the Agency takes no action on important topics, even when no consensus advice was conveyed.

After the EPA responds to the report, the chair should brief EPA sponsors and the AA (if needed) to engender agreement on actions consonant with the recommendations.