

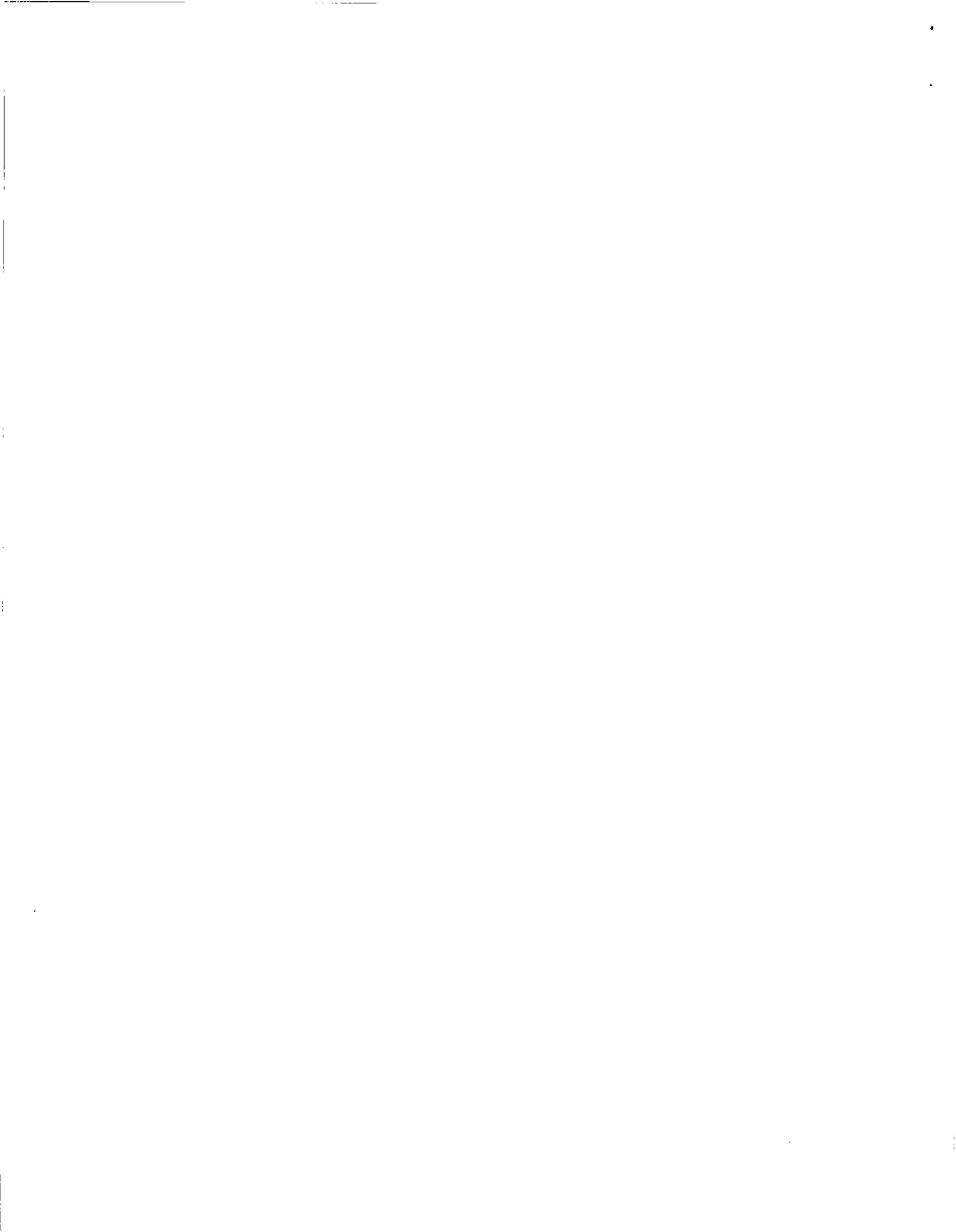


U.S. Environmental
Protection Agency

Washington, DC
EPA-SAB-EEC-90-022

**Report of the Risk Reduction
Subcommittee of the Environmental
Engineering Committee**

**Review of the ORD Risk
Reduction Core Research Strategy**





UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

EPA-SAB-EEC-90-022 OFFICE OF
THE ADMINISTRATOR

September 6, 1990

Honorable William K. Reilly
Administrator
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

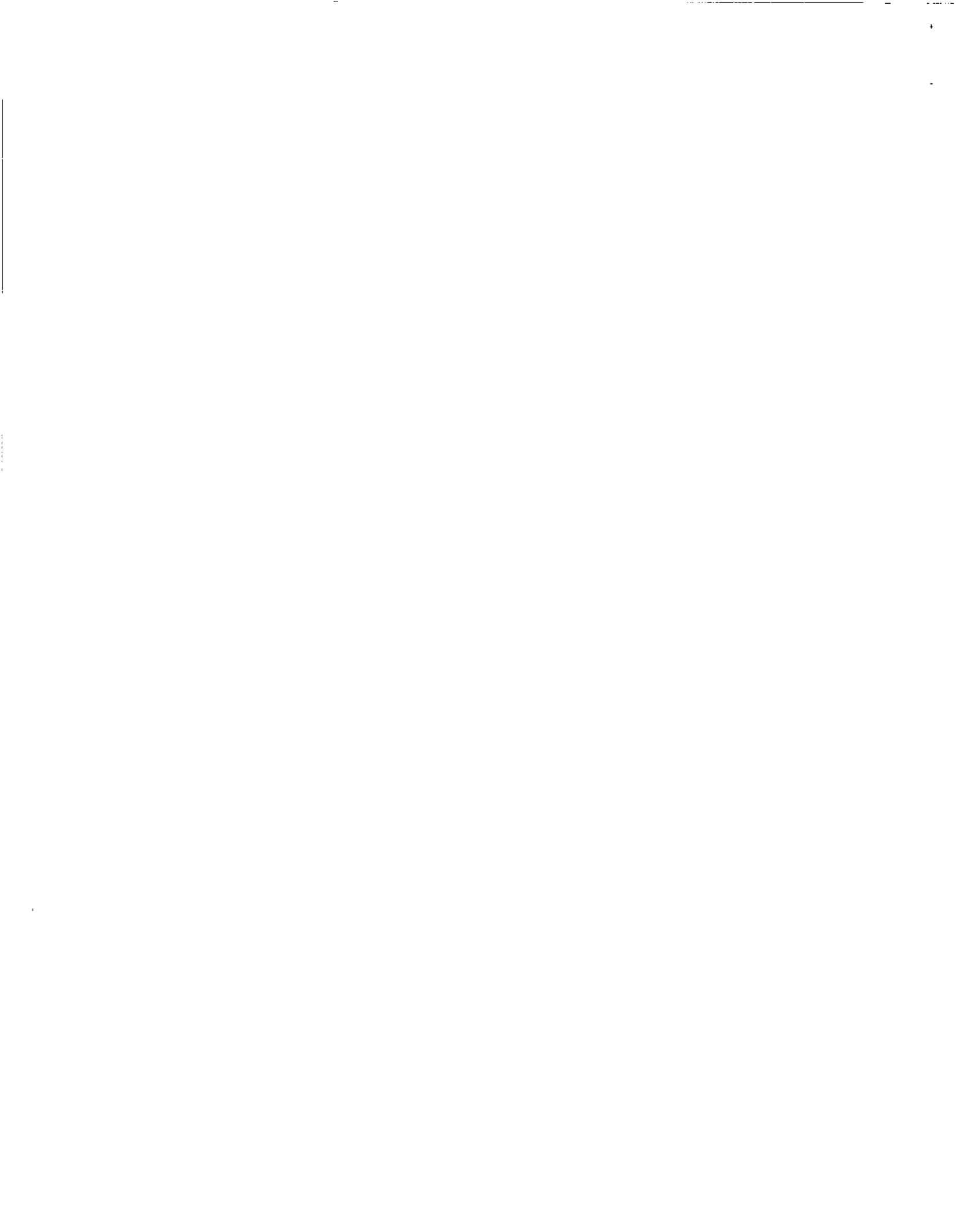
Dear Mr. Reilly:

The Science Advisory Board (SAB) has completed its review of the Office of Research and Development's (ORD) Risk Reduction Core Research Strategy. The review was based on selected materials provided to us in March of 1990 and from briefing materials and discussions with staff in a review meeting conducted on April 11-12, 1990 by the Risk Reduction Subcommittee (RRS) of the Environmental Engineering Committee (EEC). Our review was one of three SAB reviews which took place in April. The other two reviews involved examination of the Ecology Core Research and the Health Core Research.

The Subcommittee (RRS) was charged to review the core research program strategy for risk reduction and was requested to examine the conceptual strategy, appropriateness, rationale, and need for each proposed major area and sub-elements. The Subcommittee also was asked to review the strategy, to identify missing or inappropriately listed areas, and to comment on the clarity of the proposed core research plans, as well as the completeness and credibility of their justification.

The Subcommittee is very pleased with the speed of response to the SAB's prior recommendation for a core research program and with the level of care, detail and planning that has gone into current documents pertaining to the proposed risk reduction core research strategy. The ORD has selected many appropriate topics on which to focus in a core research risk reduction program. The following major findings and recommendations are made with a view toward improving this excellent beginning to the core research program.

The Agency must institute more effective mechanisms for recruiting and sustaining talented researchers oriented toward the



solution of long-term environmental problems. This will require the development and maintenance of a sufficient human resources pool, both within the Agency and in the complementary public and private sectors. This entails supporting environmental education in the universities and creating a research environment within EPA that attracts innovative new research staff, as well as retains talented senior personnel. The absence of attention to the education and training of professionals weakens the viability of the whole core research agenda.

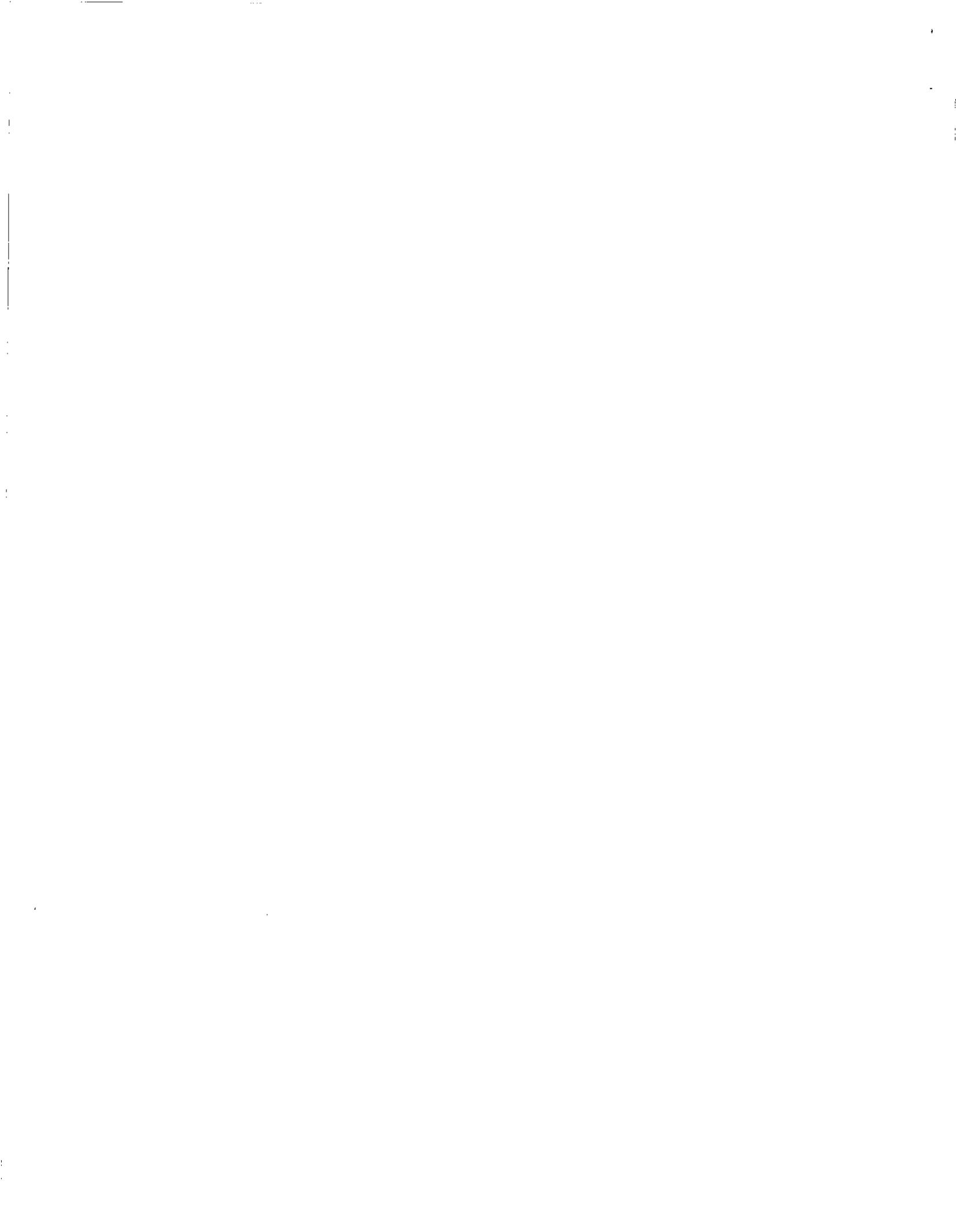
With regard to pollution prevention, the ORD summary in the core research reflects incorporation of most of the SAB's prior recommendations with one important exception, namely research on criteria and methods for measuring progress in achieving pollution prevention objectives. Also, the Agency should take the leadership role to coordinate the related research efforts of other Federal agencies.

The emerging and future issues topic areas are well chosen, in that they represent long-term problems with far-reaching consequences, and together offer broad coverage of air, water and land problems. The Subcommittee emphasized, however, that attending to already recognized environmental problems should not be allowed to distract from the equally important task of anticipating future issues. In fact, in the SAB's Future Risk Report (SAB-EC-88-040), the SAB criticized the Agency's past research posture for its exclusive devotion to the "definition, assessment, and control of existing problems."

The Subcommittee noted, in the course of their review, that two of the high risk areas identified by the SAB Relative Risk Reduction Strategy Committee were not addressed by the core research program. The areas were habitat alteration and worker exposure to chemicals. The Subcommittee also urges the Agency to pay due attention to core research on contaminant transport and fate processes.

One void in the core research area is containment. While continued research in combustion processes is certainly warranted, the areas of biodegradation and land disposal, including containment are equally important. Land disposal options are a central need for the nation for municipal and industrial wastes, and will obviously remain a very important and needed waste management option, despite the fact that the nation is moving toward preventing waste generation and encouraging recycling and treatment of wastes. The core research program for land disposal should not wait for five years.

With regard to information and communications, attention should be given to collaborative efforts between the social scientists and environmental scientists. This link is essential



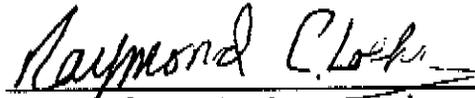
for timely anticipation of future risks, as well as for effective information dissemination.

Clearly, "core" and "short term, routine or programmatic" research need better distinction, so that the integrity of the core initiative can be preserved. The Agency's process of assigning priorities, at least in the past, has seemed to overemphasize short-term marketability which jeopardized the viability of balanced, long-term non-programmatic research.

It appears that OMB, the Congress and the Agency all need to be better educated and informed as to the need for core research and how it will better help us to achieve environmental protection goals in the long-range view of things. In fact, the implementation strategy should stress the Agency's need to develop a culture that recognizes the values and benefits of sustained long-term basic research.

We appreciate the opportunity to provide advice to the Office of Research and Development with regard to their core research proposals for risk reduction. We are pleased to have had the opportunity to be of service to the Agency, and look forward to your response to this report.

Sincerely,



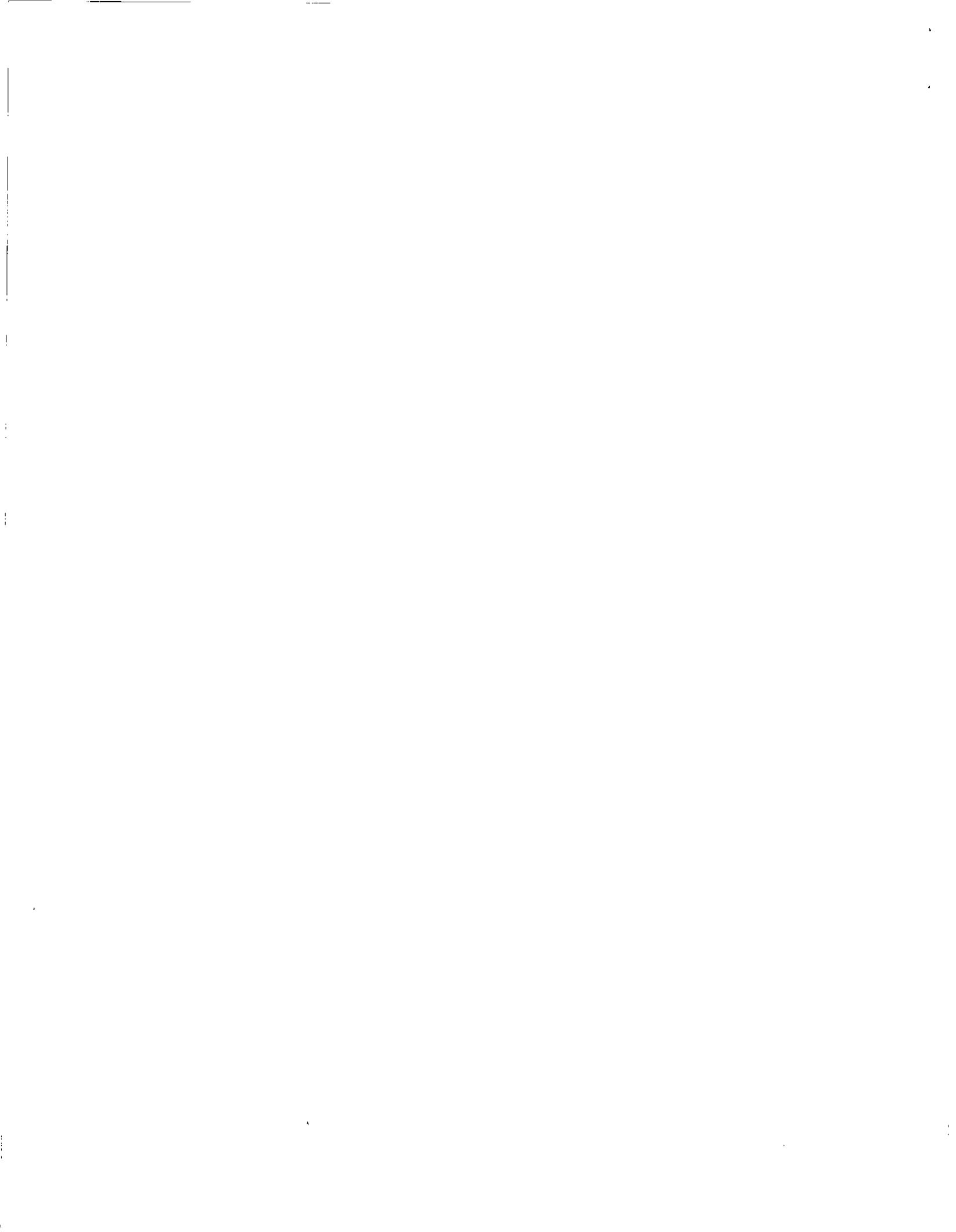
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Paul V. Roberts, Chairman
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Science Advisory Board



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ABSTRACT

The Risk Reduction Subcommittee (RRS) of the Environmental Engineering Committee (EEC) of the EPA Science advisory Board (SAB) has prepared a report on the Agency's proposed Risk Reduction Core Research Strategy. The Subcommittee examined issues within the core research proposal for risk reduction and answered the issues posed by the EPA's Office of Research and Development (ORD) relating to clarity of conceptual strategy, appropriateness of major areas for research, the appropriateness and completeness of research proposed within each of the sub-elements, and the rationale and need for each sub-element.

The Subcommittee examined five major topical areas related to the core research program for risk reduction: pollution prevention, pollution control, emerging and future issues, information and communication, and the implementation strategy.

The Subcommittee's findings and recommendations for long-term sustained risk reduction core research address the need to develop a culture that recognizes the values and benefits of sustained long-term core research as contrasted to the short-term marketability of programmatic research. The Subcommittee stresses the need to institute more effective mechanisms for recruiting and sustaining talented researchers oriented toward long-term environmental problems and for the maintenance of a sufficient human resources pool at all skill levels, both with the Agency and in the complementary public and private sectors. The Subcommittee also urges ORD to 1) develop criteria on methods for measuring progress in the area of pollution prevention initiatives, 2) recognize land disposal for municipal and industrial wastes as a disposal option of continuing importance, and 3) incorporate a substantial element of contaminant transport and fate research into the core research plan.

KEY WORDS: Core Research, Risk Reduction, Pollution Prevention, Pollution Control, Public Information and Communication

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Director, Science Advisory Board
Dr. Donald G. Barnes
Science Advisory Board (A101)
U.S. Environmental Protection Agency
401 M Street S.W.
Washington, D.C. 20460

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1.0 EXECUTIVE SUMMARY

This report presents the EPA Science Advisory Board's (SAB) review of the Office of Research and Development's (ORD) proposed risk reduction core research strategy. This review is based upon the working draft Risk Reduction Core Research Report, published on March 12, 1990 and information obtained in briefings and presentations by the ORD staff to the Risk Reduction Subcommittee (RRS) at a meeting on April 11-12, 1990.

The following highlights of the findings and recommendations for the Agency's risk reduction core research are made with the view toward improving this excellent beginning to the core research program:

- 1) ORD should distinguish more clearly between long-term, sustained "Core" research aimed at anticipatory future challenges and short-term programmatic research required to deal with immediate environmental problems, so that the integrity of the core initiative can be preserved. The Agency needs to develop a culture that recognizes and supports the long term contributions of sustained, anticipatory research.
- 2) More attention must be paid to developing and sustaining a sufficient human resources pool, not only within the Agency, but also in the complementary public and private sectors. The lack of emphasis on the education and training of professionals weakens the viability of the whole agenda.
- 3) With regard to pollution prevention, the ORD summary in the core research reflects incorporation of most of the SAB's recommendations (See Appendix C-2, reference #12) with one important exception: research is needed on criteria and methods for measuring progress in achieving pollution prevention objectives. It would be valuable to develop "criteria" for socially and environmentally preferable products. This would encourage and guide the development of such products in the private sector. Further, the Agency should take the leadership role to coordinate the related research efforts of other Federal agencies. In our review, we also observed that the plan for core research in pollution control clearly reflects far greater Agency experience than that proposed for pollution prevention. We caution the Agency not to treat the pollution prevention paradigm simply as a new slogan, while falling back to the more familiar pollution control initiatives.

- 4) Continued and innovative research is warranted in the areas of combustion, biodegradation and land disposal, including those features such as containment and control systems. Land disposal, and particularly landfilling, will remain a very important and requisite waste management option for wastes of both municipal and industrial origin, despite the recent emphasis on source reduction and recycle. Funding for the existing land disposal research program should be increased significantly, and the core research element on that topic should not be delayed for five years.
- 5) The emerging and future issues topic areas are well chosen, in that they represent long-term problems with far-reaching consequences, and together offer broad coverage of air, water and land problems. The Subcommittee emphasized, however, that attending to already recognized environmental problems should not be allowed to distract from the equally important task of anticipating future issues. In fact, in the SAB's Future Risk Report (SAB-EC-88-040), the SAB criticized the Agency's past research posture for its exclusive devotion to the "definition, assessment, and control of existing problems." Additional findings and recommendations are as follows:
 - a) Current Agency strategy for Municipal Solid Waste (MSW) (i.e., source reduction, recycle, reuse, incineration and land-filling residual ash) is reflected in the proposed program. However, much of the proposed program should be covered in the pollution prevention and pollution control area, rather than under the emerging issues,
 - b) Other aspects of municipal solid waste management should be included, such as 1) anaerobic fermentation or chemical processing for alcohol or gasoline recovery, and 2) system performance (particularly for landfills) as well as (3) risk reduction effectiveness and cost effectiveness studies,
 - c) The global climate core research area as described is an innovative and appropriate niche for contributions by EPA to a much broader Federal research effort on global climate change,
 - d) The water supply core research area appears to have properly identified the significant unresolved issues requiring attention,

- e) Alternative fuels research should be subsumed under the pollution prevention category,
 - f) The oil spills research should address fresh water and river systems, as well as the marine environment and should be expanded to encompass chemical spills,
 - g) The non-point source research appears to involve considerable risk assessment, rather than direct risk reduction, and
 - h) The indoor air quality research section is well developed, with proper balance between risk assessment and risk reduction.
- 6) The proposed program for anticipating future risks is weak, in that it relies almost entirely on environmental monitoring and data analysis. Moreover, the proposed core research program for environmental monitoring and data analysis neglects the need to improve knowledge of the phenomena that control contaminant transport and fate. Detailed findings and recommendations are as follows:
- a) Without basic research on contaminant behavior in the environment, environmental monitoring and data analysis will remain a crude tool, regardless of the quality of data and the kinds of statistical analyses applied; transport and fate research is a requisite for early anticipation of emerging and future issues. Although this type of research logically belongs in the realm of ecological research, it is apparently completely neglected in the core research program proposed for that area, as well as in the risk reduction core program. ORD should redress this oversight by building on transport and fate research,
 - b) To better anticipate future risks ORD should also explore innovative means of identifying future problems and their prospective solutions by 1) analyzing social/economic/technological trends, and 2) using expert scientific vision on a continual basis, and
- 7) The development of methods to control and mitigate habitat alteration and worker exposure should be considered as part of the research program for risk reduction, in conjunction with other agencies currently responsible for addressing these issues.

- 8) The information and communications chapter raises many broad issues which require greater public understanding and participation; new core research initiatives in this domain are welcomed. However, the planned initial funding level is far too low. Also, the chapter could be strengthened with examples of what might be achieved through the research.

Attention should be given to collaborative efforts between social and environmental scientists. This link is essential for understanding human response to environmental risks, and for effective information dissemination concerning environmental problems.

- 9) The implementation strategy should stress the Agency's need to develop a culture that recognizes the value and benefits of sustained long-term basic research. The Agency's process of assigning priorities, at least in the past, has seemed to have overemphasized short-term marketability to the detriment of a balanced, long-term non-programmatic research program. Additional findings and recommendations relative to the implementation strategy are as follows:

- a) The implementation strategy focuses on budgetary priorities and staging, without making explicit proposals. The apparent emphasis on near-term payback, although understandable as a means of gaining support, is at odds with the spirit of the SAB's previous advice,
- b) The Agency must institute more effective mechanisms for recruiting and sustaining talented researchers oriented toward long-term environmental problems. This entails supporting environmental education in the universities and creating a research environment within EPA that attracts innovative new research as well as retains talented senior personnel. This approach would encourage a proactive attitude toward anticipating future problems, as well as provide continuity in the research program, and
- c) We recommend that the ORD review the combined implementation plan from the standpoint of balance and comprehensiveness, including the human resources and institutional aspects, as well as the interfaces among risk reduction, environmental effects, and health effects.

2.0 INTRODUCTION AND BACKGROUND

In March, 1990, the Office of Research and Development (ORD) provided the Risk Reduction Subcommittee (RRS) of the Science Advisory Board (SAB) with a working draft report of the Risk Reduction Core Research Strategy (See Appendix A and Appendix C-2, reference #4). This report is a product of earlier SAB suggestions to establish a core research program for risk reduction (See Appendix C-2, references 7, 8, 9 & 10).

The SAB was asked to review the Risk Reduction Core Research Strategy and assigned the review to the Environmental Engineering Committee (EEC). The EEC established a Risk Reduction Subcommittee (RRS), members of which are listed in this report.

The Subcommittee (RRS) was charged to review the core research program strategy for risk reduction and was requested to examine the following:

- 1) Is the conceptual strategy clear?
- 2) Do we have the appropriate major areas for research? Have we asked the right questions?
- 3) Within each of the major topics, do we have the proper sub-elements? What's missing? What doesn't belong?
- 4) Is the rationale and need for each sub-element clear and convincing?
- 5) Are the types of research proposed within the sub-elements appropriate?

The Subcommittee met on April 11-12, 1990, in Washington, D.C., to hear presentations and discuss the report with the ORD staff. During the meeting, the RRS was provided with briefing materials and formal presentations on the first day. The second day of the meeting was dedicated largely to report writing activity by the RRS, but sufficient time was allowed to convey verbally to the ORD staff the details of the RRS findings and recommendations, so that they would be in a position to immediately rewrite their draft report.

3.0 RISK REDUCTION CORE RESEARCH STRATEGY AREAS ADDRESSED IN REVIEW

3.1 Overall Comments on the Core Research Program

These comments relate to the material in the working draft of the EPA-ORD Risk Reduction Core Research Strategy dated March 12, 1990.

In 1988, the SAB issued a report, Future Risk: Research Strategies for the 1990's, (see references 7, 8, 9 & 10) that provided advice to EPA on ways to improve strategic research planning at EPA. One of the ten major recommendations was that EPA should plan, implement, and sustain a long-term, core research program in areas where it has unique responsibilities and capabilities. The EPA Office of Research and Development (ORD) has responded to this recommendation by developing a core strategy for EPA that will generate knowledge essential to all areas of environmental decision-making, as well as for the immediate regulatory needs of EPA's program offices. This core research program will strengthen and expand existing efforts and initiate substantial new efforts in critical areas.

This Risk Reduction Subcommittee is very pleased with the speed of response to the SAB recommendation for a core research program and with the level of care, detail, and planning that has gone into current documents. Continuing careful thought, resolve for such a program, as well as a marshalling of resources will be necessary to make the program the keystone of long-term EPA success in protecting human health and the environment. It is imperative that this initial resolve and action be continued and that adequate resources be provided for the directions and topics that have been identified and recommended. If the resolve is diverted or the resources not provided, ORD will have lost an important opportunity to provide the long-term leadership and knowledge needed by the Agency.

3.2 Pollution Prevention

In March 1990, EPA's Office of Research and Development transmitted its Pollution Prevention Research Plan as a Report to Congress. The pollution prevention component of the risk reduction core research strategy is derived from the Report to Congress, which was previously reviewed in draft by the SAB (See Appendix C-2, reference #12). Most of the recommendations by the SAB made in that review have been incorporated into the pollution prevention core research program. This program is comprehensive, broadly conceived, and supportive of a shift in focus of the Agency's environmental protection strategy from end-of-pipe controls to preventing pollution at the source.

The SAB has endorsed pollution prevention as one of the most important risk reduction initiatives that EPA can take in the next decade. We consider it appropriate, therefore, to include the critical elements of pollution prevention research in the overall risk reduction core research strategy, provided that the central role of pollution prevention in reducing future risk is not lost. In its review of the Report to Congress on pollution prevention research, the SAB cautioned the Agency to steer clear of the normal tendency to build incrementally on existing (i.e., known and comfortable) programs in early years. In this review of the Agency's integrated core pollution prevention and pollution control research strategy, the Subcommittee cautions against too great an emphasis on incremental improvements in pollution control, where the EPA has had years of experience, to the detriment of the bold new steps needed to support a shift toward a pollution prevention paradigm. The Subcommittee's specific recommendations relate to:

- 1) Clarification of research objectives,
- 2) Modifications to program elements, and
- 3) Additions and refinements to the research plan.

3.2.1. Clarification of Research Objectives

All of the research objectives should be stated so that a determination can be made as the program progresses of whether or not they have been met. Such a determination is virtually impossible for objectives stated in terms of "encourage" or "stimulate." As examples, how will the Agency determine whether or not:

- 1) Its product research has "encouraged" private sector development of environmentally preferable products?
- 2) Its process research has "stimulated" cross-industry application?
- 3) Its reuse/recycling research has "stimulated" additional capacity for using recycled materials?
- 4) Its technology transfer and technical assistance program has "stimulated" pollution prevention opportunity assessments?

Objectives stated in terms of "establish", "identify", and "demonstrate", "develop", "conduct", or "quantify" have much clearer, measurable end points and are greatly to be preferred.

3.2.2. Modifications to Program Elements

The following recommendations are offered to clarify or strengthen the various program elements:

- 1) The pollution prevention chapter as a whole could be improved by incorporation of a few specific examples within each program element.
- 2) Product and Process Research:
 - a) Product Research is proposed on methods for conducting assessments, identifying opportunities, and developing/using "preferable" products. The research would be enhanced by also including applications - perhaps a series of ORD reports on the life cycle of specific products or product classes, the impacts on the environment at each stage, and pollution prevention opportunities,
 - b) It should be recognized that few new products can be completely harmless to the environment. The plan should note, therefore, that "environmentally preferable products" are those that place less burden on the environment, and research in the area should reflect this perspective,
 - c) The Agency could provide a valuable service to industry and the public by establishing criteria for identifying environmentally preferable products. The criteria should include disposal as well as production and use,
 - d) The Agency should evaluate its own past experience in pollution prevention, e.g. assess the efficacy of its pollution prevention activities in the broad sense, including product formulation, (such as is undertaken under the Toxic Substances Control Act (TSCA), and
 - e) Available information from numerous activities already in progress in industry should be collected and utilized in the early part of the program, including the data bases being compiled under the auspices of SARA Title III.
3. Socioeconomic and Institutional Research:
 - a) The research plan should include identification of both incentives and barriers, including statutory and regulatory barriers.

4. Technology Transfer and Technical Assistance:

- a) The information obtained from socioeconomic, institutional, and anticipatory research should be disseminated, as well as that for product, process, and recycling/reuse research, and
- b) It would be more appropriate to call this activity Information Transfer rather than Technology Transfer.

5. Anticipatory Research:

- a) In reviewing pollution prevention, as a stand-alone research program, the SAB endorsed Anticipatory Research as an important component. Within the integrated core research program, anticipatory research in pollution prevention should be incorporated into the overall research effort in Emerging and Future Issues, and should be the first approach considered in addressing those issues as they are identified, and
- b) Several of the areas discussed under Emerging and Future Issues are excellent examples of pollution prevention research that might be undertaken. Specifically:
 - 1) Municipal Solid Waste: strategic planning source reduction, recycling,
 - 2) Global Climate Change: development of CFC substitutes, identification of barriers, and incentives for switching,
 - 3) Stratospheric Ozone Depletion: the example cited of a cooperative effort in recycling mobile air-conditioning refrigerant is a fine example of a technically-oriented pollution prevention project,
 - 4) Nonpoint Source Pollutants: controlling the amount, timing, and manner of agricultural chemical application to within the limits of the assimilative capacity of the environment, and
 - 5) VOCs and HAPs: substitutes, alternative feedstocks and processes, recovery/reclamation/reuse.

3.2.3. Additions and Refinements to the Research Plan

The following materials separately reviewed by the SAB would be valuable additions to the report:

- a) The charts on risk reduction research budget and initiated priorities among pollution prevention research program elements, similar to what was presented to the Subcommittee in the April 11-12, 1990 review meeting,
- b) The "Next Steps" Addendum to the pollution prevention chapter, with "Results Expected", specified in terms which would allow objective evaluation of whether or not they were achieved,
- c) One area of research recommended by the SAB in its review of the Report to Congress on pollution prevention is not reflected in the current document. This is research on criteria and methods for measuring progress in pollution prevention. It is important because:
 - 1) Most of the published work in the field has been anecdotal. While many of the available case examples demonstrate spectacular successes in reducing waste generation at the source, with relatively short pay-back periods, the impact on total waste generation has been too small to be measurable,
 - 2) Many of the State Capacity Assurance Plans assume very significant reductions in the quantities of hazardous waste seeking off-site treatment and disposal. Yet no state provides substantive data on the degree of reduction possible or how it is to be achieved, and
 - 3) No tested and validated methodology exists to even begin to assemble information that could eventually lead to the establishment of measurable objectives.
- d) The Pollution Prevention Research Branch Current Projects Summary, dated February 1990, proposes a project on "Methodology for Measuring Pollution Prevention". The project is well conceived and appropriately funded at \$300 thousand over a two year period. A principal investigator had not been selected at the time of publication of the report,

- e) An additional role recommended for EPA is coordination of related pollution prevention research efforts by other Federal agencies such as DOD, DOE, USDA, DOT, etc. Such coordination is needed to eliminate duplication and achieve better cooperative efforts, and
- f) Finally, the Subcommittee recommends additional funding for anticipatory research in FY91. The results for anticipatory and socioeconomic and institutional research could serve as the "guiding light" to point the direction of needed industrial and social behavior changes. It may take a long time to gain valuable information from anticipatory research and the current funding is inadequate.

3.3 Pollution Control

The pollution control research program reflects the Agency's extensive experience in pollution control research endeavors, and thus comprises a mature, low-risk proposal. The Subcommittee generally supports the core research agenda proposed in this area, but urges the Agency to define priorities and identify a unifying theme for core research. Specific findings and recommendations relating to pollution control strategy are as follows:

- 1) The overall core research agenda is very ambitious, with quantum changes in funding levels however prioritized. If such support materializes, "core" research and short-term regulation-oriented research need better distinction so that the integrity of the core initiative can be preserved. There is a lack of a unifying theme for the core research program. The Subcommittee had some difficulty in distinguishing the elements of the core initiative from the regulation-oriented research. The terms "keystone" and "cornerstone" research are not clearly defined and consistently used in the report. The unifying theme is needed to keep the core research in balance and prevent it from becoming lost by intermingling with the regulation-oriented research.
- 2) There appears not to be adequate attention given to the development and maintenance of a sufficient human resources pool, both within the Agency and in the complementary public and private sectors. Beyond the attempts to suggest technology transfer (information transfer) and public education programs, the absence of attention on the education of professionals weakens the viability of the whole research agenda. If innovative, competent personnel are lacking, the additional funds devoted to future core research will likely be ill-spent.

- 3) The Agency's perception of needs and priorities does not necessarily reflect attitudes outside the Agency. The chapter tended to treat everything as if there is a need to do core research. Several of the processes being proposed for core research have been an integral part of past research initiatives. There is the outside perception that the Agency may not have performed any fundamental or core research in these areas. EPA does not give itself adequate credit for the success of their earlier efforts.
- 4) The pollution control chapter tends to view processes, or controls, as separate entities without sufficient emphasis on the "integrated systems" approach. The chapter was very specific in discussing certain technologies, while other technologies were essentially neglected.
- 5) The Subcommittee recommends several changes in priorities. Although continued research is warranted in the combustion area, the areas of residuals management, biodegradation, and land disposal/containment are of equal or greater importance. Many treatment residues will ultimately be landfilled. Hence, this area of land disposal research needs immediate attention. The environment as an appropriate and necessary ultimate receptor of residuals should be recognized; environmental assimilative capacity needs to be integrated into the overall technological perspective. It is recommended that work in disposal of residuals be elevated in priority, with greater emphasis on the overall performance of land disposal systems and the integrity of their structural elements.
- 6) Containment technologies use various forms of barriers, such as liners, to separate harmful materials from the environment. The core research should address the question of how effective these barriers are in protecting the environment from landfilled waste. The strategy document also notes that "an information gap still exists on aspects of the performance, reliability and cost of many of the control technologies" now being used to reduce risk. These are appropriate topics on which to focus a core research program.
- 7) Research to address the performance of system components is discussed, but the overall performance of land disposal systems is of equal or greater importance. Better knowledge about the performance of existing systems is important for both technical guidance and regulatory decisions. The performance-related research that is needed includes procedures for determining facility performance and use of these procedures for determination of the performance of both older and modern MSW landfills,

including those employing emerging innovative technologies.

- 8) The technical and regulatory changes that have been implemented have been made to reduce the risk to human health and the environment. However, the extent to which the actual risks have been reduced has not been documented.
- 9) Another important aspect of the core research program should be to evaluate the costs of existing and planned land disposal systems. The capital and operating costs of land disposal facilities are increasing due largely to mandated technical and regulatory requirements. Cost evaluation can be used with the risk evaluation information discussed above to better identify the costs and benefits of additional controls that may be needed to better protect human health and the environment.
- 10) Emphasis on "non-point" sources should also include agricultural areas (pp. 3-17) , as well as the control of fugitive emissions of hazardous air pollutants.

3.4 Emerging and Future Issues

To improve understanding of this section , ORD should strive for a clearer distinction between 1) issues that have only recently emerged as pressing problems, or are anticipated in the future, and 2) widely recognized, but neglected, issues.

3.4.1 General Comments on Emerging Issues

Eleven emerging issues are specified as needing greater attention, namely: municipal solid waste; global climate; stratospheric ozone; medical wastes; indoor air; non-point sources; volatile organics; water supply; alternative fuels; environmental infrastructure; and oil spills. With some exceptions, these topic areas are well chosen, in that they represent long-term problems with far-reaching consequences and together offer broad coverage of air, water, and land problems.

This section outlines in part new research programs to be founded in support of regulatory development in areas where the needs for regulation of existing problems appear imminent. This emphasis is understandable in the context of EPA's regulatory mission, yet diverges from the spirit of the SAB's advice to the Agency in "Future Risk..." (See Appendix C-2, reference #7, recommendation #4 in SAB-EC-88-040 which criticizes the Agency's past research posture for its exclusive devotion to the "definition, assessment, and control of existing problems"). It is certainly proper for EPA to assign high priority to these emerging concerns; however, the attention given to these already

perceived environmental problems should not be allowed to distract from the equally important task of anticipating future issues (i.e., those not yet perceived) in a more timely fashion than heretofore. There is an implicit danger that the emerging issues will crowd out the future issues in research budget allocation decisions, by virtue of being more imminent, and hence more subject to pressure for regulation.

The Subcommittee finds that several of the core research emerging issues are especially well chosen, and believes them worthy of priority support.

- 1) The global climate core research area is an innovative and appropriate niche for contributions by EPA to a much broader Federal research effort on global climate change,
- 2) The water treatment core research area appears to have properly identified significant unresolved issues requiring attention, and
- 3) The indoor air quality research section is well developed, with proper balance between risk assessment and risk reduction.

However, there are several emerging issues included that seem to be out of place in this portion of the core research program. Medical wastes do not seem to possess a strong need for continuing research, and what research is needed can be conducted in relation to combustion studies. Volatile organic compounds (VOCs) and hazardous air pollutants (HAPs), may be able to be covered adequately under pollution prevention and other pollution control studies, but the data from the SARA Title III Surveys should be evaluated systematically to assess VOC's/HAPs as an emerging issue.

- 4) Current Agency strategy for MSW (i.e., source reduction, recycle, reuse, incineration and land-filling residual ash) is reflected in the proposed program. However, much of the proposed program should be covered in the pollution prevention categories and in the fundamental research on combustion technology in the pollution control area, rather than under the emerging issues, and
- 5) Likewise, alternative fuels research should be subsumed under the pollution prevention category.

Several of the proposed emerging issues are appropriate as core research elements, but need to be reformulated.

- 6) The proposed oil spill research is important, but should address fresh water and river systems, as well

as the marine environment, and should be expanded to encompass chemical spills, and

- 7) The non-point source research appears to involve considerable risk assessment, rather than direct risk reduction, and should be reoriented toward source reduction.

Two missing programs of high risk to the environment, health, and/or welfare are habitat alteration and perhaps worker exposure to chemicals. The draft report of the SAB Relative Risk Reduction Subcommittee (See Appendix C-2, reference #14) substantiates the need for research aimed at lessening these risks.

3.4.2 General Comments on Future Issues

The section on future issues is broad and general, as is inevitable considering the subject matter, which deals with anticipating environmental problems that are as yet unforeseen. The section deals with analyzing environmental trends, acquiring comprehensive data bases for ambient concentrations, and assessing new risk reduction technologies. Of these categories, the first two capture the spirit of anticipating future environmental problems (See Appendix C-2, reference # 7, Future Risk, Recommendation #4), but the last category seems out of place in this section. That is, the examples listed under Future Technology and Products (accelerated application of computer and telecommunications technology; optimization of the production, distribution, and use of hydrocarbon resources; integrated biomass and high-technology energy cycles; and application of solar photovoltaics) seem to belong under pollution prevention or pollution control. To be consistent with the priorities issues, this section should address assessing new technology and products to identify future problems.

The sections on environmental monitoring and data analysis recognize the need for improved methods for data acquisition and statistical analysis, but ignore the need for improved understanding of the processes governing contaminant behavior in the relevant environmental compartments. Without adequate knowledge of the phenomena that control contaminant transport and fate, environmental monitoring and data analysis will remain a crude tool, regardless of the quantity of data and the kinds of statistical analysis applied. The effective interpretation of environmental quality data requires a profound knowledge of underlying processes and mechanisms, to provide properly formulated hypotheses to be used in the design of environmental monitoring programs and the interpretation of their results. The early identification of atmospheric ozone depletion constitutes a successful recent example of this synergism.

Accordingly, the Agency must recognize the paramount importance of transport and fate research in foreseeing future problems, and build it into their program for anticipating future risks. More data and better statistical methodologies will not suffice without better process understanding. Ideally, such research studies should be included in the Ecological Core Research Strategy, such that those concerned with interpreting ambient data will become more adept in understanding the role of transport and fate phenomena. Unfortunately, the present version of the Ecological Core Research Strategy appears not to recognize the crucial role of transport and fate research in the early identification of future problems.

The ORD report also neglects the essential task of synthesizing expert opinion to help identify future issues in an integrated way in this chapter. Ways to do this can be categorized as follows: 1) Analyze ambient/ecological/health data for evidence of nascent problems, 2) Analyze societal/economic/ technological trends and develop scenarios that would indicate future problems and possible solutions, and 3) Use expert scientific vision, based on process understanding on a continuing basis to identify new potential problems and means to address them. Only the first approach was addressed. A more complete coverage of future-issue identification seems appropriate. Such a program is described in Appendix A of Future Risk (See Appendix C-2, reference #8, pg. 11-22) and again called for in the SAB's Research Strategy Advisory Committee's, January '89 review of the ORD's Core Research Area (See Appendix C-2, reference #10, pg 11). This was agreed to by Lee Thomas (then Administrator) in a Memorandum dated 26 September 1988. This effort should be combined with the anticipatory part of The Pollution Prevention Core Program. As recommended in the documents cited above, a small staff dedicated primarily to this endeavor should be established; they would draw upon internal and external experts, rather than themselves, to address the imposing task of keeping track of developments of all kinds (technological, socioeconomic, physiographic) throughout the world that portend environmental consequences. To facilitate the gathering of external expertise, twenty (20) or so professional societies could be asked to participate in a program in which they would nominate persons to participate in expert workshops in which future problems would be identified. Perhaps four workshops could be held each year, so that each organization could be involved every 5 years. Also EPA could recruit key personnel from investigator-initiated grants, especially in the health and ecological areas, who could be asked to participate.

3.5 Information and Communication

The understanding of human response to environmental risks is critical to the management of environmental issues where individual decisions affect the levels of pollutants introduced to the

environment and the subsequent exposure. Examples include consumer product choices which affect the quantities of municipal solid wastes and household hazardous products introduced to the environment, and indoor air pollution and household water quality problems, where homeowner decisions to sample and remediate limit the potential impact of risk reduction efforts.

Proper information dissemination is essential to appropriately focus limited Agency resources and avoid redundant efforts. The Subcommittee is concerned that, as currently written, the chapter is weak in comparison to the other chapters and thus does not adequately convey the importance of the issue. This can be rectified by the addition of examples of what might be achieved through the research. Such examples would make the benefits more tangible and lessen the probability that this area would be the first to suffer budget cuts in this predominantly hard science research program.

The Subcommittee is gratified to see the Agency committing resources to this research area. However, the initial funding level appears to be so inadequate that it is unlikely that anything of significance can be accomplished. The initial funding level should be increased and the long range funding plan should call for consistent growth. The limited funds can be stretched by means of leveraged research efforts with other organizations.

Financial resources are not the only resources in limited supply. Personnel resources in the environmental area are extremely limited and are expected to become more limited. Without adequately trained personnel, core research cannot be successfully conducted. To provide the trained personnel resources, the Agency should consider resurrecting the traineeship program. This should be augmented with an effort to promote environmental education and awareness at all levels. There is no need for the Agency to prescribe environmental curriculum. The diversity of curricula that currently exists in the University system is critical to providing the many diverse viewpoints that are needed to move us toward a cleaner environment.

With regard to new initiatives, the Subcommittee strongly supports the Agency's dedication to the commercialization of new environmental technologies and products. Commercialization is essential to elevating the quality of available environmental treatment technologies. An economic study is needed to determine how the private sector might "internalize the externalities" in their economic decision-making, such that public-sector benefits are reflected in the private sector decisions. Such a study would provide useful perspectives. These efforts, as all efforts in the information and communication area, could benefit from teamwork between social and environmental scientists. The link is essential for understanding human response to risks and for effective information dissemination concerning environmental problems. To

better understand changes in environmental risk perception which occur over time, there is a need for an improved data base on consumer and behavioral issues related to risk decisions. The need is for the equivalent of a social sciences "EMAP".

Finally, on page 5-2 of Reference #4, in Appendix C-2, the media bullet is too harsh and should be softened to: "Extensive media reporting of environmental problems."

3.6 Implementation Strategy

The implementation strategy focuses on budgetary priorities and staging, without making explicit proposals. The emphasis on near-term payback, although understandable as a means of gaining support, is nonetheless at odds with the spirit of the SAB's previous advice. The Agency's process of assigning priorities seems to have overemphasized short-term marketability to the detriment of the viability of a balanced, long-term nonprogrammatic research program. The Agency needs to develop a culture that recognizes the long-term contributions of sustained, basic research, apart from short-term payoffs. This is the essence of the SAB's message in "Future Risk...." The Subcommittee believes that ORD is unduly defeatist in abandoning the quest to establish a constituency for sustained, long-term research at the outset of the core research planning process. ORD and the Agency must undertake to convince Congress and OMB of the value of and need for core research.

The implementation strategy combines existing ("core-like") and incremental core research. This confuses the issue and complicates review of the implementation plan. Further, it raises the spectre that the core research program may be perceived as competing with existing program-oriented research. ORD should also describe the interrelationship between the proposed core research program and the investigator-initiated projects in exploratory research, avoid unnecessary overlap, and assure communication between those two research channels.

The implementation strategy neglects the non-budgetary aspects of initiating and sustaining the core research program. The Agency must recognize that the success of the core research program depends critically on human resources, as well as on coordination with other Agencies and cooperation with other institutions, including the private sector and the academic community. Such interactions should be incorporated into the implementation strategy. The Agency must institute more effective mechanisms for recruiting and sustaining talented researchers oriented toward long-term problems in the environmental field, both within EPA and in other segments of the environmental research community. This entails supporting environmental education in the universities and creating a research environment within EPA that attracts creative new researchers and retains talented senior personnel, provides

continuity, and encourages a pro-active attitude toward anticipating future problems.

Apart from these general considerations, the Subcommittee is not able to review the implementation strategy in depth owing to the lack of comprehensive, detailed documentation. We recommend that the SAB Research Strategies Advisory Committee review ORD's combined implementation plan from the standpoint of balance (connection to investigator-initiated grant program and balance between in-house and extramural research), procedures for future planning, external input, proactive assessment, and peer review and comprehensiveness (e.g., the apparent omission of research on contaminant transport and fate), including the human resources and institutional aspects.

APPENDIX A - REQUEST FOR SAB REVIEW



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
RESEARCH AND DEVELOPMENT

MEMORANDUM

SUBJECT: SAB Review of Core Risk Reduction Program

MAR 13 1990

FROM: Peter W. Preuss, Director *Peter W. Preuss*
Office of Technology Transfer and Regulatory Support

TO: SAB Environmental Engineering Committee

Enclosed for your review is *Risk Reduction Core Research Strategy*, the Office of Research and Development's (ORD's) plan for core research in risk reduction. Also included for background information is the original core research plan, *Protecting the Environment: A Research Strategy for the 1990s*.

In order to provide you with more background for your review, I want to explain what the document is that you will be reviewing, how your review can most assist us, and what will happen next with these research plans.

First, let me explain how this document developed and what it represents. In April, 1989, ORD published its core research plan, *Protecting the Environment: A Research Strategy for the 1990s*. This plan was reviewed by the SAB's Research Strategies Advisory Committee, and outlined 4 areas of emphasis for EPA's fundamental research program: (1) Ecological Risk Assessment; (2) Health Risk Assessment; (3) Risk Reduction; and (4) Research Grants. The document we are asking you to review is a further expansion and refinement of the risk reduction portion of the overall core program.

Since April, 1989, we have spent our time better defining the three technical areas. Out of that process have come three documents, one of which is the risk reduction document provided to you today. These three documents will be reviewed by three standing SAB committees. Each document attempts to define the universe of research we think should be included in a core research program. These are not research proposals; thus, we have not provided resource estimates. However, each document does try to give an idea of the size of certain program areas relative to others and the timing of the research. These documents are what we call "working drafts"; they are not final documents.

Second, let me discuss how your review can most assist us as we continue to

plan our core research program. In general, we would appreciate your reaction to this "working draft", and your suggestions on the directions we're going with our research programs. Some questions you may want to think about as you're reviewing the document include:

- Is the conceptual strategy clear?
- Do we have the appropriate major areas for research? Have we asked the right questions?
- Within each of the major topics, do we have the proper sub-elements? What's missing? What doesn't belong?
- Is the rationale and need for each sub-element clear and convincing?
- Are the types of research proposed within the sub-elements appropriate?

It would be most helpful to us if the review was an interactive one. If you have questions prior to the meeting, please feel free to contact Darwin Wright of ORD's Office of Environmental Engineering and Technology Demonstration (OEETD) at (202) 382-4073. Fred Lindsey, Director of OEETD, Darwin, and other ORD staff will be available during the meeting on April 11 and 12. We would appreciate your immediate feedback, either verbal or written, as we need to have this document, as well as the other documents, complete for the beginning of the budget process in early summer.

Third, I want to let you know what will happen following SAB review. We will make revisions to the documents in response to your comments. At the same time, we will be developing an executive summary that will tie the three parts of the core program together and that will set some general priorities among the three areas. The executive summary and the three documents will be sent for review to the SAB's Research Strategies Advisory Committee, sometime in May, and to the EPA Research Strategy Council thereafter. Once we get directions from the SAB and others, we will look at the timing of the research; for example, what research will be conducted first, what will be second, etc. From this, we will decide what research should be initiated in FY 92 and in the succeeding years to fulfill these plans.

Finally, I want to thank you for your help with ORD's research program, especially the core program, and for taking on this review. I understand how busy you are and appreciate you rearranging your schedule for this review. If we can provide you with any additional material, please let me know.

APPENDIX B - GLOSSARY OF TERMS AND ACRONYMS

BDAT	BEST DEMONSTRATED AVAILABLE TECHNOLOGY
CFC'S	CHLORO FLUORO-CARBONS
CH ₄	METHANE
CO ₂	CARBON DIOXIDE
DOD	DEPARTMENT OF DEFENSE
DOE	DEPARTMENT OF ENERGY
DOT	DEPARTMENT OF TRANSPORTATION
EEC	ENVIRONMENTAL ENGINEERING COMMITTEE OF THE SAB
EMAP	ENVIRONMENTAL MONITORING ASSESSMENT PROGRAM
EPA	ENVIRONMENTAL PROTECTION AGENCY
FY	FISCAL YEAR
HAP	HAZARDOUS AIR POLLUTANTS
MSW	MUNICIPAL SOLID WASTE
NOAA	NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
N ₂ O	NITROUS OXIDE
OMB	OFFICE OF MANAGEMENT AND BUDGET
ORD	OFFICE OF RESEARCH AND DEVELOPMENT
OTTRS	OFFICE OF TECHNOLOGY TRANSFER AND REGULATORY SUPPORT OF THE ORD OF THE EPA
RREL	RISK REDUCTION ENGINEERING LABORATORY OF THE EPA
RRS	RISK REDUCTION SUBCOMMITTEE OF THE EEC (ALSO REFERRED TO AS THE SUBCOMMITTEE)
RSAC	RESEARCH STRATEGIES ADVISORY COMMITTEE OF THE SAB
SAB	SCIENCE ADVISORY BOARD OF THE U.S. ENVIRONMENTAL PROTECTION AGENCY
SARA	SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT
TSCA	TOXIC SUBSTANCES CONTROL ACT
US	UNITED STATES
USCG	UNITED STATES COAST GUARD
USDA	U.S. DEPARTMENT OF AGRICULTURE
U-V	ULTRA VIOLET RADIATION
VOC	VOLATILE ORGANIC CONTAMINANTS

APPENDIX C - RESOURCE MATERIAL AND REFERENCES CITED -

C-1 BACKGROUND ARTICLES, BRIEFINGS AND MATERIALS
PROVIDED TO THE SCIENCE ADVISORY BOARD BY THE
OFFICE OF RESEARCH AND DEVELOPMENT OF THE
ENVIRONMENTAL PROTECTION AGENCY

- 1) American Institute of Pollution Prevention, US EPA Brochure, 1989.
- 2) Background Articles, Briefings and Materials Provided to the SAB by ORD
- 3) Bridges, James S., Waste Minimization Assessments at Selected DOD Facilities, RREL, US EPA, Cincinnati, Ohio
- 4) Brown, Lisa M. and Johnny Springer, RREL, US EPA, Cincinnati, Ohio and Matthew Bower, APS Materials, Inc, Dayton, Ohio, Chemical Substitution for 1,1,1-Trichloroethane and Methanol In Manufacturing Operations.
- 5) Chapter 5: Information and Communication (Briefing).
- 6) Comments by Darwin R. Wright for SAB Review of ORD's Risk Reduction Core Research Report - Emerging and Future Issues, April 11, 1990.
- 7) Curran, Mary Ann and Kenneth R. Stone, Evaluation of EPA Waste Minimization Assessment, RREL USEPA, Cincinnati, Ohio.
- 8) Howell, S. Garry, A Ten Year Review of Plastics Recycling RREL, US EPA, Cincinnati, Ohio.
- 9) ORD FY91 2% Set Aside Projects.
- 10) Pollution Control (Briefing by Gregory Ondich).
- 11) Pollution Control -- Containment Processor (Briefing by Gregory Ondich).
- 12) Pollution Prevention, Research Plan Report to Congress (Briefing)
- 13) Relative Risk Reduction Strategy Committee (Draft Report) (1990)
- 14) Summary of Projects Funded Through the 2% Set-Aside, November 14, 1989.
- 15) US EPA, ORD, ORD FY90 Multimedia Properties by Subject.

APPENDIX C-2 - REPORTS CITED

- 1) US EPA, Office of Research and Development, Draft Pollution Prevention Research Plan Report to Congress, February 15, 1989.
- 2) US EPA, Office of Research and Development, Pollution Prevention Research Plan Report to Congress, Feb. 1990.
- 3) US EPA, Office of Research and Development, Protecting the Environment: A Research Strategy for the 1990's, Draft, April 1989, (Also referred to as The Whale Book.
- 4) US EPA, Office of Research and Development, Risk Reduction Core Research Report, Working Draft, March 12, 1990.
- 5) US EPA, Office of Research and Development, Risk Reduction Core Research Strategy Addendum ("Next Steps" Priority Research Items for Each Research Area), Working Draft, March 12, 1990.
- 6) US EPA Office of Research and Development, Risk Reduction Core Research Strategy Directory, Working Draft, March 12, 1990.
- 7) US EPA, Science Advisory Board, Future Risk: Research Strategies for the 1990's, SAB-EC-88-040, Sept. 1988.
- 8) US EPA, Science Advisory Board, Appendix A: Strategies for Sources, Transport and Fate Research, SAB-EC-88-040A, September 1988.
- 9) US EPA, Science Advisory Board, Appendix E: Strategies for Risk Reduction Research, SAB-EC-88-040E, Sept. 1988.
- 10) US EPA, Science Advisory Board, Report of the Research Strategies Advisory Committee, Review of ORD's CORE Research Areas, EPA-SAB-RSAC-89-013, January 1989.
- 11) US EPA, Science Advisory Board, Report of the Municipal Waste Combustion Ash Subcommittee, Review of the ORD Municipal Waste Combustion Ash Solidification/Stabilization Research Program, EPA-SAB-EEC-90-010, March 1990.
- 12) US EPA, Science Advisory Board, Report of the Pollution Prevention Subcommittee, Review of the ORD Draft Pollution Prevention Research Plan: Report to Congress, EPA-SAB-EEC-89-037, September 1989.

- 13) US EPA, Science Advisory Board, Report of the Environmental Engineering Committee, Resolution on Use of Mathematical Models by EPA for Regulatory Assessment and Decision-Making, EPA-SAB-EEC-89-012, January 1989.
- 14) US EPA, Science Advisory Board, Relative Risk Reduction Strategy Committee, Reducing Risk: The Value of An Integrated Environmental Policy, Draft Report, August 12, 1990.