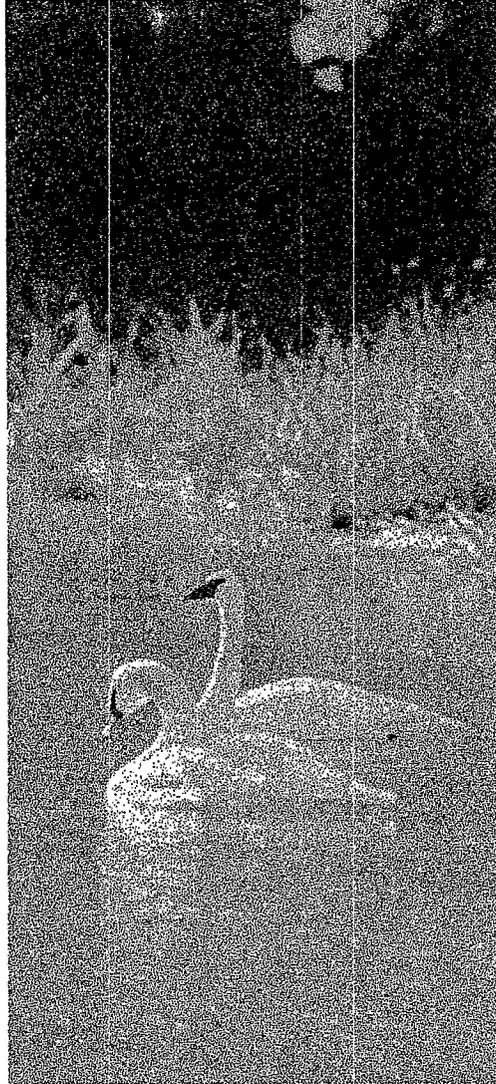
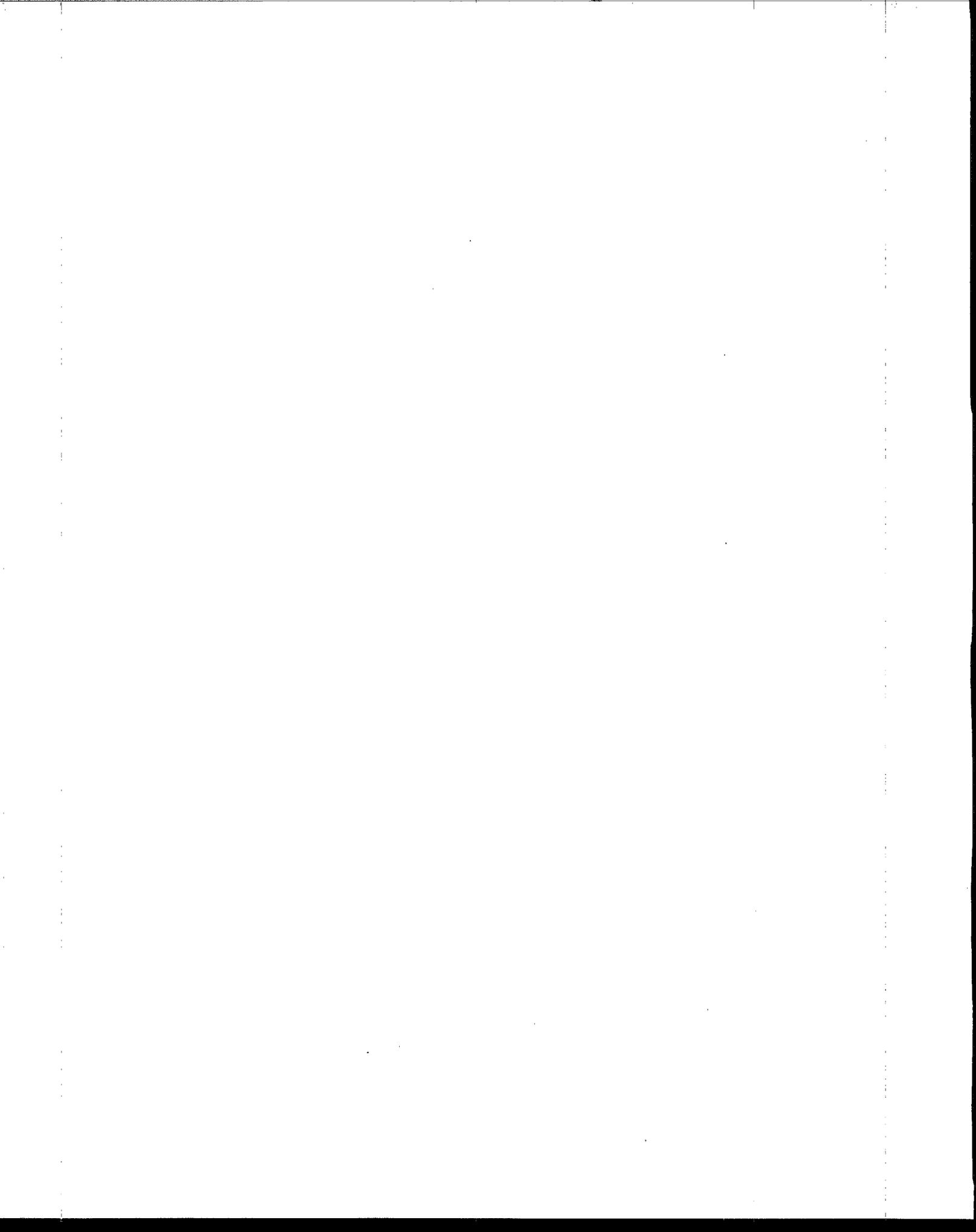




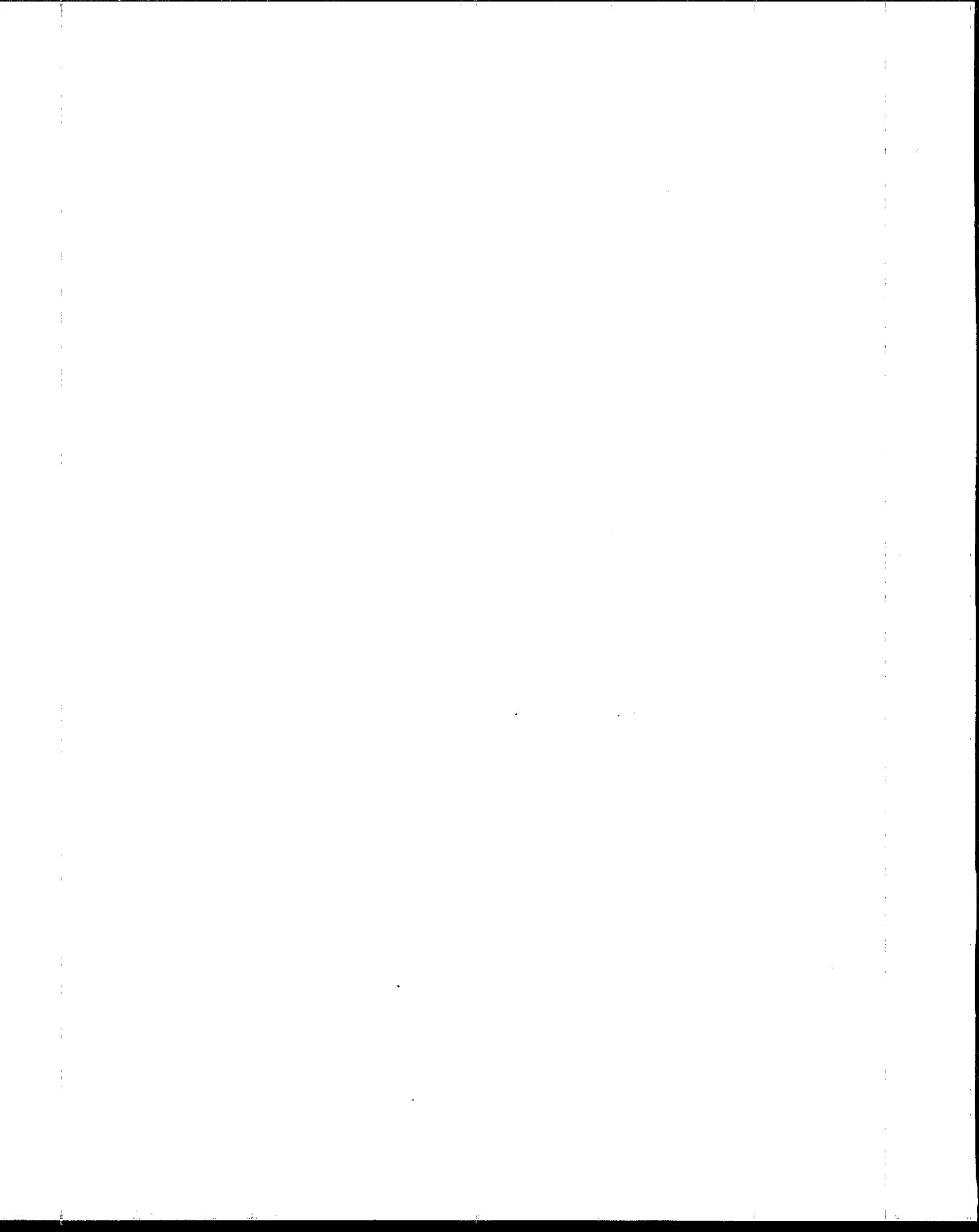
# Safeguarding the Future: Credible Science, Credible Decisions





This report was written by the Expert Panel on the Role of Science at EPA. The Panel is an independent advisory committee established solely to provide to the EPA Administrator a set of recommendations for how the Agency can best meet the goal of using sound science for its decisionmaking. The contents of this report do not necessarily represent the views and policies of EPA or of other federal agencies.

*Cover photos by S.C. Delaney*





Safeguarding the Future:  
Credible Science, Credible Decisions

*The Report of the Expert Panel  
on the Role of Science at EPA*

to

William K. Reilly  
Administrator  
U.S. Environmental Protection Agency

March 1992

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January 8, 1992

Mr. William K. Reilly  
Administrator  
U.S. Environmental Protection Agency  
Washington, DC 20460

Dear Mr. Reilly:

Earlier this year, you asked us to help identify how EPA can meet the goal of using sound science as the foundation for the Agency's policy and program decisions. You asked us to recommend ways to: (a) ensure that EPA has up-to-date, objective scientific information for decisionmaking, (b) ensure that EPA's planning, resources, and leadership produce the knowledge base needed to achieve the Agency's new vision, (c) ensure that the research and scientific information needs of the programs and regions are met, and (d) enhance the stature of science within EPA and among the many constituencies with which EPA interacts.

To accomplish this task, we interviewed more than 30 individuals who have experience with these issues. We also held three public meetings that included individuals from various EPA offices and programs, other government agencies, industry, environmental groups, and other organizations. In addition, we requested written comments and received letters from more than 25 individuals, primarily from the EPA regional offices. We were impressed that so many people wished to help EPA find better ways to acquire and use sound scientific information.

A number of consistent themes emerged from the discussions and comments. Everyone who spoke with the Panel agreed that EPA needs its own strong science base to carry out its mission effectively. At the same time, the Agency needs to make certain structural changes to improve the quality of its science and the way science is used in decisionmaking. In this report, we have developed these themes as a series of findings and recommendations about science at EPA. Included are suggestions for both short- and long-term measures to enhance the use of sound scientific and technical information throughout the Agency.

We look forward to your serious consideration of these findings and recommendations and encourage you to take the necessary next steps as soon as possible. We appreciate the opportunity to be of assistance.

Sincerely,

Expert Panel on the Role of Science at EPA

Raymond C. Loehr, Chair  
Bernard D. Goldstein  
Anil Nerode  
Paul G. Risser

# Contents

	Page
TRANSMITTAL LETTER .....	ii
EXECUTIVE SUMMARY .....	1
THE EXPERT PANEL .....	10
BACKGROUND .....	13
FINDINGS AND RECOMMENDATIONS	
I. THE MISSION AND DIRECTION OF EPA SCIENCE .....	16
II. THE QUALITY OF SCIENCE AT EPA .....	23
III. THE QUALITY OF SCIENTISTS AT EPA .....	29
IV. HOW THE BUDGET PROCESS AFFECTS SCIENCE AT EPA .....	33
V. HOW EPA USES SCIENCE IN DECISIONMAKING .....	36
APPENDICES	
A. STRATEGIC DIRECTION FOR THE U.S. ENVIRONMENTAL PROTECTION AGENCY .....	39
B. CHARGE TO THE EXPERT PANEL (MAY 22, 1991) AND AFFILIATIONS OF PANEL MEMBERS .....	43
C. PERSONS INTERVIEWED BY THE EXPERT PANEL .....	46
D. RECORD OF PUBLIC MEETING ATTENDANCE AND WRITTEN COMMENTS .....	49



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# Executive Summary

## BACKGROUND

The mission of the U.S. Environmental Protection Agency (EPA) is to preserve and improve the quality of the environment, protect human health, and safeguard the productivity of natural resources on which all human activity depends. To achieve these aims, the Agency is committed to ensuring that "national efforts to reduce environmental risk are based on the best available scientific information communicated clearly to the public" (*Strategic Direction for the U.S. Environmental Protection Agency: EPA...Preserving Our Future Today*, 1991). EPA also is dedicated to "providing leadership in the nation's environmental science, research, and assessment efforts." This includes:

- Gathering and analyzing the data needed to evaluate environmental risks and trends, measure environmental results, and inform the choices of institutions and individuals throughout society.
- Promoting and supporting innovative technological solutions to environmental problems.
- Encouraging and conducting research that improves our understanding of health and ecological risks.
- Providing objective, reliable, and understandable information that helps build trust in EPA's judgment and actions.
- Sharing research findings and innovative technologies with other nations.

In addition, EPA must be able to anticipate environmental problems caused by new and existing technologies and by societal changes.



## BACKGROUND (CONTINUED)

Several recent reports, including *Future Risk: Research Strategies for the 1990s* (1988, SAB-EC-88-040) and *Reducing Risk: Setting Priorities and Strategies for Environmental Protection* (1990, SAB-EC-90-021), stressed that EPA must have a strong science base to accomplish these goals. Scientific knowledge has assumed an increasingly critical role as the environmental issues faced by the nation and the world grow in complexity and cut across all environmental media. The Agency must improve the scientific data and analytical methodologies needed to make sound decisions; to set risk-based priorities for protecting health and the environment; to support a new emphasis on protecting the health of the nation's ecosystems (such as forests, lakes, and wetlands); and to contribute to international environmental efforts.

## THE EXPERT PANEL ON THE ROLE OF SCIENCE AT EPA

In early 1991, EPA Administrator William K. Reilly established the Expert Panel on the Role of Science at EPA as an independent advisory committee under the Federal Advisory Committee Act. The Expert Panel was charged with evaluating how EPA can meet the goal of using sound science as the foundation for Agency decisionmaking. The four members of the Panel were:

- Dr. Raymond C. Loehr (Chair of the Panel), H.M. Alharthy Centennial Chair in Civil Engineering, University of Texas.
- Dr. Bernard D. Goldstein, Director, Environmental and Occupational Health Sciences Institute, Rutgers University and University of Medicine and Dentistry of New Jersey—Robert Wood Johnson Medical School.
- Dr. Anil Nerode, Professor of Mathematics and Computer Science, Goldwin Smith Chair and Director, Mathematical Sciences Institute, Cornell University.
- Dr. Paul G. Risser, Provost and Vice President for Academic Affairs, University of New Mexico.

These individuals conduct extensive research programs and have had considerable experience with various EPA programs. In addition, they have served on national committees evaluating scientific and technical programs.

## APPROACH

Over a period of four months, the Panel held three public meetings and interviewed more than 30 individuals from EPA, other government agencies, industry, environmental groups, and other organizations. The Panel also requested written comments and received letters from more than 25 individuals, primarily from the EPA regional offices.

The Panel performed no other independent evaluation of science at EPA; it did not review current research programs, visit EPA laboratories, or examine reports and data generated by EPA program and regional offices. Given the short time available for the Panel's review, the Panel determined that interviews and meetings with knowledgeable individuals within and outside EPA would be a more effective means of responding to its charge.

The meetings and discussions focused on five topics that are crucial to obtaining and using sound science for credible decisions:

- The mission and direction of EPA science.
- The quality of science at EPA.
- The quality of scientists at EPA.
- How the budget process affects science at EPA.
- How EPA uses science in decisionmaking.

The Panel defined science as encompassing a range of activities, including research and development, technical and regulatory support, monitoring, data collection, review and interpretation of technical studies, and assessments of health and environmental risk. The Panel intentionally included the science activities carried out in EPA program, policy, and regional offices, since such activities are part of the science EPA uses for decisionmaking. It also included the quantitative social sciences, such as economics, in addition to the physical, chemical, and biological sciences.

MAJOR FINDINGS  
AND  
RECOMMENDATIONS

*Overall, the Panel affirms that EPA needs its own strong science base to provide the background required for effective environmental protection programs.*

The Panel found that several consistent themes and concepts emerged from the meetings, interviews, and letters. These are summarized in the findings and recommendations presented in subsequent sections of this report. Overall, the Panel affirms that EPA needs its own strong science base to provide the background required for effective environmental protection programs. Currently, EPA science is of uneven quality, and the Agency's policies and regulations are frequently perceived as lacking a strong scientific foundation. To remedy these problems, the Panel recommends that EPA leadership undertake a deliberate and continuing effort to create the climate, culture, and incentives necessary to encourage superior science. The Panel recommends several specific structural changes to enable EPA to obtain and use the high-quality science it needs to realize its mission. These changes address science throughout the Agency, not only in the Office of Research and Development (ORD). The Panel's central findings and recommendations are listed below.

1

**FINDING:** EPA does not have a coherent science agenda and operational plan to guide scientific efforts throughout the Agency and support its focus on relatively high-risk environmental problems.

**RECOMMENDATION:** The Agency has moved in the right direction with its new issue-based planning process. EPA should further develop this process with the overall goal of producing a broadly based, rational plan to acquire and use the best scientific information. This planning process should apply to science throughout the Agency. Through this process, EPA can break from the past and shift toward the cross-media, anticipatory research needed to address complex, long-term, and global environmental problems.

2

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**FINDING:** EPA has not clearly conveyed to those outside or even inside the Agency its desire and commitment to make high-quality science a priority.

**RECOMMENDATION:** EPA should send strong, clear signals to the scientific community and the public about its commitment to develop and use the best science for guidance and decisions. One immediate step to accomplish this could be the initiation of regular science briefings for the Administrator by EPA and non-EPA scientists on topics of critical concern to the Agency.

*The Panel recommends that EPA leadership undertake a deliberate and continuing effort to create the climate, culture, and incentives necessary to encourage superior science.*

3

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**FINDING:** The science advice function—that is, the process of ensuring that policy decisions are informed by a clear understanding of the relevant science—is not well defined or coherently organized within EPA.

**RECOMMENDATION:** The Administrator should appoint a “science advisor” to ensure that credible scientific information for EPA guidance and decisions is available from both EPA scientists and the broader scientific community. The science advisor would implement a peer review and quality assurance program for all EPA’s science-based products, improve the Agency’s responsiveness to the science needs of EPA policymakers, play a key role in evaluating the professional activities of all scientists at EPA, and provide scientific advice to the Administrator.

**MAJOR FINDINGS  
AND  
RECOMMENDATIONS  
(CONTINUED)**

**4**

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**FINDING:** In many cases, appropriate science advice and information is not considered early or often enough in the decisionmaking process.

**RECOMMENDATION:** EPA should take steps to ensure that science enters the decisionmaking process early and often. In regulatory development, EPA should implement a widely advertised, open process enabling the Agency to hear the scientific opinions of all parties. In addition, the Agency should analyze how it used science in developing one or more major regulations. The goal of this analysis would be to determine the type of scientific and technical information needed to ensure scientifically credible decisions, as well as the points in the regulatory process at which scientific input is most effective. The analysis should take into account the varying needs and decisionmaking processes of the different EPA program offices.

**5**

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**FINDING:** The development and nurturing of human resources are central to improving science at EPA.

**RECOMMENDATION:** For ORD scientists, the Panel recommends continued attention to appropriate science and science management career tracks. For scientists in EPA program and regional offices, the Panel recommends establishing a science career track similar to that in place for those providing legal advice. The Agency also should enhance rotational opportunities that allow EPA scientists to participate in the broader scientific community and non-EPA scientists to work more closely with EPA's science programs.

6

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**FINDING:** EPA requires that its scientific research products undergo peer review. However, the Agency does not have a uniform process to ensure a minimum level of quality assurance and peer review for *all* the science developed in support of Agency decisionmaking.

**RECOMMENDATION:** Quality assurance and peer review should be applied to the planning and results of *all* scientific and technical efforts to obtain data used for guidance and decisions at EPA, including such efforts in the program and regional offices. Such a requirement is essential if EPA is to be perceived as a credible, unbiased source of environmental and health information, both in the United States and throughout the world.

7

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**FINDING:** A number of outstanding externally recognized scientists work at EPA. However, the Agency lacks the critical mass of externally recognized scientists needed to make EPA science generally credible to the wider scientific community.

**RECOMMENDATION:** EPA should recruit four to six research scientists or engineers with world-class reputations and provide them with a significant, long-term commitment of support. These individuals should be national and international leaders in scientific areas vital to the Agency's long-term strategy and direction. They would serve as mentors for developing scientists and provide access to networks of world-class scientists.

MAJOR FINDINGS  
AND  
RECOMMENDATIONS  
(CONTINUED)



8

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**FINDING:** For EPA to establish a reputation for having high-quality science to support its decisionmaking, its science activities must become more widely known. Academia, Congress, other federal agencies, industry, and the public generally are unfamiliar with the work of EPA scientists.

**RECOMMENDATION:** The Agency should undertake a communications, outreach, and education effort to publicize the activities and accomplishments of EPA scientists.

9

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**FINDING:** EPA often does not evaluate the impact of its regulations. Implementation of an environmental policy or regulation provides a unique opportunity to study the environmental response to changes brought about by regulations, such as changes in the type and amount of pollutants.

**RECOMMENDATION:** The Agency should scientifically evaluate the environmental improvements brought about by the major regulations it promulgates. This will help EPA better understand the effectiveness of its regulatory strategies and how those strategies affect environmental processes.

10

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**FINDING:** EPA science could benefit substantially from increased scientific contact and openness with other organizations.

**RECOMMENDATION:** The Agency should encourage increased participation of its scientists in the activities of the scientific community. It should enhance relationships with other federal agencies and appropriate industrial and academic research organizations and promote the participation of EPA scientists in the technical activities of professional societies.

11

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**FINDING:** EPA has not consistently enlisted the nation's best scientists to provide the research and technical information needed for decisionmaking. Problems in the Agency's approach to academic grants and centers have discouraged many university-based experts from working with EPA. In addition, the program and regional offices and ORD laboratories often rely on contractual mechanisms that prevent EPA from obtaining the best outside scientists to work on EPA issues.

**RECOMMENDATION:** EPA should move quickly to bolster its grants and centers program. The Agency also should implement a long-term plan to replace contractual mechanisms that may be detrimental to obtaining the best possible scientific information.



## The Expert Panel

EPA's 1991 statement of strategic direction (Appendix A) calls for sound science to serve as the foundation for the Agency's policy and program decisions. In May 1991, EPA Administrator William K. Reilly established the Expert Panel on the Role of Science at EPA as an independent advisory committee to the Agency under the Federal Advisory Committee Act. The Panel, consisting of Drs. Raymond C. Loehr (Chair), Bernard D. Goldstein, Anil Nerode and Paul G. Risser, was charged with developing recommendations to help the Agency achieve the following goals:

- Identify how best to provide the Administrator with up-to-date, objective scientific information in keeping with the Agency's new strategic direction.
- Ensure that the knowledge base necessary to achieve the new vision is available through proper planning, adequate resources, and necessary leadership.
- Ensure that the research and scientific information needs of the programs and regions are adequately met and their views incorporated in the scientific advice provided to the Administrator.
- Enhance the stature of science within EPA and among the many constituencies with which the Agency interacts.

The Administrator asked the Panel to work with the Assistant Administrator for Research and Development and other EPA offices to accomplish this task and asked the program Assistant Administrators to cooperate fully in this endeavor. Additional details about the charge to the Panel and the affiliations of Panel members are included in Appendix B.

The Administrator asked that the Panel report back with its recommendations in four to six months. Given this short time frame, the Panel decided to rely primarily on interviews with key science and policy leaders, both within and outside EPA, to identify areas of concern and generate ideas for solutions. The Panel did not conduct any other independent evaluation of science at EPA; it did not review current research programs, visit EPA laboratories, or examine reports and data generated by the program and regional offices.

Over a period of four months, the Panel held three public meetings to discuss the role of science at EPA. It also interviewed more than 30 individuals from EPA, other government agencies, industry, environmental groups, and other organizations. These discussions took place in closed fact-finding sessions to ensure an open expression of views. Because the time available for interviews was limited, the Panel also requested written comments. More than 25 individuals, mostly from the EPA regional offices, sent written comments to the Panel. Appendix C lists the individuals interviewed by the Expert Panel and Appendix D lists those who attended the public meetings or provided written comments.

The Panel completed its fact-finding in September 1991. The Panel thanks everyone who attended the public meetings, participated in discussions, and submitted comments for their candid and helpful input. The Panel apologizes to the many people it was unable to interview in person.

During the meetings and discussions, the Panel focused its attention on five topics crucial to the acquisition and use of sound science in support of decision-making at EPA:

- The mission and direction of EPA science.
- The quality of science at EPA.
- The quality of scientists at EPA.
- How the budget process affects science at EPA.
- How EPA uses science in decisionmaking.



In this report, the Panel uses the term "science" in its broadest sense: it encompasses a range of activities, including research and development, technical and regulatory support, monitoring and data collection, review and interpretation of technical studies, and assessments of health and environmental risks. By using this definition, the Panel intentionally includes the scientific activities conducted by EPA program, policy, and regional offices; these activities are part of the science EPA uses in its decisionmaking. The Panel also includes the quantitative social sciences, such as economics, as well as the biological, chemical, and physical sciences.

A number of consistent concepts and views emerged during the Panel's fact-finding process. Everyone who spoke with the Panel agreed that EPA needs its own strong science base to carry out its mission effectively. At the same time, all expressed concerns about the quality of EPA science and encouraged improvements in the way EPA uses science in decisionmaking. The following pages detail the Panel's findings concerning science at EPA and recommendations for addressing those concerns. These findings and recommendations represent the Panel's synthesis and evaluation of the ideas provided in the interviews, public meetings, and written comments.

# Background

The basic mission of EPA is to preserve and improve the quality of the environment, protect human health, and safeguard the productivity of natural resources on which all human activity depends. In carrying out this mission, EPA must implement the programs mandated by law as its first priority. However, it has responsibilities beyond the activities mandated by legislation. It also must provide leadership on the scientific and policy issues involved in environmental protection. In addition, EPA must develop, evaluate, and use risk reduction strategies, including those that go beyond the conventional command-and-control regulatory approach, in varying political, cultural, and social contexts.

Previous advisory reports stressed that EPA needs a strong scientific base for its decisions. *Future Risk: Research Strategies for the 1990s* (1988, SAB-EC-88-040) and *Reducing Risk: Setting Priorities and Strategies for Environmental Protection* (1990, SAB-EC-90-021) made many recommendations about science at EPA. *Future Risk*, for example, recommended that EPA plan and implement a long-term research program in specific core research areas, improve its capability to anticipate environmental problems, and expand its efforts to understand how and to what extent people are exposed to environmental pollutants. *Reducing Risk* argued that, to take advantage of the best opportunities to reduce risk, EPA must improve the data and analytical methodologies that support the assessment, comparison, and reduction of different environmental risks.

Many changes are under way in ORD, the program offices, and the regional offices to bring about needed changes in EPA science. This report builds on previous advisory reports to EPA, current activities within EPA, and the knowledge of individuals in other government agencies and the private sector who have faced similar problems in providing high-quality science for decision-making. The report focuses on structural changes to ensure that EPA science can help the Agency realize its new vision for environmental protection. These findings and recommendations are another building block in EPA's efforts to safeguard human health and the environment.

## THE ROLE OF SCIENCE AT EPA



**A**ccording to EPA's 1991 statement of strategic direction (Appendix A), EPA is committed to ensuring that national efforts to reduce environmental risk are based on the best available scientific information communicated clearly to the public. EPA should be a credible source of science information for all parties within and outside EPA. To achieve this goal, the Agency must acquire scientific information from its own programs as well as from industry, academic institutions, other government agencies, private organizations, and other nations.

A key role of science at EPA is to reduce uncertainties in environmental decision-making. While scientists have made significant progress in measuring and comparing risks to human health and the environment, many uncertainties remain. For example, most of our current knowledge concerning how humans respond to environmental pollutants comes from research with laboratory animals under conditions very different from those that humans actually experience. Many uncertainties, therefore, are involved in deducing how the information gained through this laboratory research applies to people. Other areas of uncertainty include the impact of chemical mixtures and other general stressors on the environment. People and ecosystems are exposed not simply to single chemicals, but to mixtures of different chemicals. The environment is also affected by complex, diffuse factors such as temperature changes, habitat loss, and ozone depletion. EPA historically has focused on chemical-specific impacts and has not developed methods to assess or control the effects of chemical mixtures and general stressors on humans and ecosystems.

Science is especially necessary to characterize today's subtle and complex environmental problems that cut across all environmental media (air, water, and land) and transcend national boundaries, such as loss of species diversity, acid deposition, and stratospheric ozone depletion. Science, in fact, is inherently cross-media and international in nature and can be the catalyst for focusing greater attention on cross-media environmental issues.

Science is also key to determining which environmental problems pose the greatest risks to human health, ecosystems, and the economy. In the absence of sound scientific information, it is likely that high-profile but low-risk problems will be targeted, while more significant threats are ignored. When science and

data are uncertain, regulations and policies are often developed to protect every person or every ecosystem uniformly against hazards that few will actually experience. This can impose a heavy burden on the economy and society without providing better protection for most of the population or the nation's ecosystems. The technical support programs maintained by EPA and other agencies are essential to developing the scientific information needed to accurately gauge the costs and benefits of proposed regulations and nonregulatory strategies.

In addition, science is critical for developing cost-effective strategies to reduce environmental risks. It provides a foundation for the Agency's efforts to make greater use of alternatives to traditional approaches to risk reduction, to develop and improve pollution control technologies, and to identify changes that all sectors of society can make to prevent or reduce pollution.

Finally, science is needed to help anticipate future environmental problems. For example, carefully structured monitoring programs combined with rigorous analysis can paint an accurate picture of present conditions, describe what is happening to an individual or an ecosystem over time, and help predict the environmental consequences of future actions. If scientists can identify emerging environmental trends and their consequences, EPA and the nation can take steps now to reduce the risks posed by these trends, rather than pay the much larger costs to address problems that have evolved to maturity.

In short, science is one of the soundest investments the nation can make for the future. Strong science provides the foundation for credible environmental decisionmaking. With a better understanding of environmental risks to people and ecosystems, EPA can target the hazards that pose the greatest risks, anticipate environmental problems before they reach a critical level, and develop strategies that use the nation's, and the world's, environmental protection dollars wisely.



## The Mission and Direction of EPA Science

**E**PA's environmental protection strategies are undergoing important shifts—for example, toward setting risk-based priorities, a greater emphasis on pollution prevention, and increased attention to reducing ecological risks. To support and help define these changes, the mission and direction of EPA science must evolve as well.

In addition, because limited resources prevent EPA from being equally strong in all areas, the Agency must clearly define the mission and direction of its science activities. Other organizations (such as other government agencies, academic institutions, and industry) have strong programs in scientific and technical areas pertinent to the interests of EPA; information from those programs should be available and used for EPA guidance and decisionmaking. Therefore, it is important to identify the scientific areas in which EPA should maintain its own strength.

The Panel addressed the following questions regarding the mission and direction of EPA science:

- In which scientific areas should EPA be a leader, and in which should it be primarily a catalyst for and a user of information?
- How can the Agency be aware of and acquire information from the broader scientific community?
- How is the Agency's strategic planning process shaping the mission and direction of EPA science?
- To what extent is EPA's desire to base decisions on the best scientific information recognized outside EPA?
- What is the perception of EPA science in the broader scientific community and among decisionmakers who draw upon scientific and technical knowledge?



## FINDINGS

1. EPA needs its own strong science base to provide the scientific foundation for effective decisionmaking. This is true for a number of reasons:
  - EPA decisions frequently are controversial and affect broad sectors of society and the economy. Controversial issues demand a strong science base when decisions are made.
  - EPA cannot rely only on other government agencies to develop the scientific information it needs for decisionmaking.
  - The existence of its own science base allows EPA to tie science to long-term regulatory objectives and other environmental protection strategies.
  - Interaction between scientists and policymakers is essential for sound decisionmaking.
  - Some scientific activities, such as controlled human exposure studies, require special facilities that are beyond the capability of most university-based research programs.

Several examples clearly illustrate the importance of in-house EPA expertise. In the early 1980s, non-ionizing radiation was thought to present little risk to human health. As a result, EPA lost its funding for the handful of researchers it had in this area. This loss of in-house expertise has left the Agency in an awkward position as it attempts to respond to today's rapidly escalating concerns about the health effects of non-ionizing radiation.

In contrast, in the mid-1980s, EPA was able to obtain adequate funding to begin a research program in the new field of biotechnology. The Agency recruited a number of scientists who were experts in using the tools of modern biology. When the *Exxon Valdez* spilled 11 million gallons of crude oil in Prince William Sound, Alaska, in 1989, these scientists helped lead a highly acclaimed research effort to develop a cleanup method using microorganisms to break down oil on contaminated beaches.

FINDINGS  
(CONTINUED)



2. Regulations are based on both technical and policy considerations. Improper decisions can result if either the scientific or policy input is flawed. A perception exists that regulations based on unsound science have led to unneeded economic and social burdens, and that unsound science has sometimes led to decisions that expose people and ecosystems to avoidable risks.
3. Despite substantial efforts on the part of the Agency, most people outside EPA do not recognize that EPA has made strong science a priority.
4. A number of scientists and engineers at EPA are recognized as being very knowledgeable, conducting state-of-the-art research, and/or being highly skilled at synthesizing and analyzing information. Overall, however, the science base at EPA is not *perceived* as strong by the university community, Congress, other federal agencies, or industry. Most EPA scientists are not seen as playing a dominant or even influential role in the scientific community. Several individuals indicated that EPA science has been virtually invisible when broad national environmental policy issues are discussed and developed.
5. Many officials involved in funding EPA science are uncertain about what science products EPA has produced, and whether the quality and quantity of these products are commensurate with the dollars expended. When Congressional committees ask for a justification of proposed laws or regulations, expert EPA scientists rarely are made available as a matter of course to answer questions about the scientific defensibility of Agency decisions.

EPA policy and regulatory work receives a great deal of public attention; EPA science receives a similar degree of attention only when the scientific basis of a decision is questioned. It is crucial, therefore, that the Agency consistently place its scientific goals and achievements before the public eye.

6. In response to the Science Advisory Board's recommendations in *Future Risk: Research Strategies for the 1990s*, EPA established a core research program. The core program is designed to generate knowledge to support *all* areas of environmental decisionmaking, not just the immediate needs of the program offices. The program also is intended to maintain a core of expertise and

resources that will provide the continuity needed for effective research. The original priorities of the core program included:

- Monitoring baseline conditions and trends in the nation's ecosystems.
- Developing new tools and strategies for pollution prevention.
- Establishing a national database on the extent and nature of human exposure to pollutants.
- Determining the human health effects of multiple exposures to low levels of pollutants.
- Supporting academic research on environmental problems.

There appears to be increasing recognition across the Agency that fundamental research is needed to support EPA's strategic direction. The areas addressed in the core program are somewhat narrow, however, and the core research budget, while growing, is a small fraction of the Agency's overall science budget.

7. EPA lacks a coherent agenda for science throughout the Agency. It also lacks a coherent operational plan for its science activities (that is, a plan for identifying the most important scientific issues and a rational organizational approach to acquiring the necessary scientific information). Both are essential to support the Agency's focus on relatively high-risk, cross-media environmental problems. EPA's science strategy must include plans for science activities to anticipate future environmental problems. The only certain prediction for the future is that an environmental issue of critical importance that no one has predicted will appear; EPA must have a strong science base and flexibility to deal with unanticipated problems.
8. EPA must draw on the expertise of other organizations to obtain the best scientific information available. Currently, however, the Agency lacks adequate mechanisms for acquiring such information from the broader scientific community.



Global environmental issues represent one area in which EPA needs to tap the expertise of other scientific organizations. EPA unquestionably is the lead agency representing the United States on international environmental matters, such as global warming and deforestation. This role has grown in importance as the nation realizes how events elsewhere on the planet affect the U.S. environment, as well as how environmental controls can improve economic productivity and international competitiveness. EPA cannot fulfill this role, however, unless it obtains scientific information from scientists throughout the nation and the world.

## RECOMMENDATIONS

1. EPA should make a deliberate effort to create and maintain the climate, culture, and incentives necessary to encourage superior science at EPA.
2. The Administrator should send broad, clear, and continuing signals within EPA, to the wider scientific community, and to the public about the importance of having high-quality science to protect health and the environment. Examples of actions EPA could undertake include:
  - Requesting periodic briefings for the Administrator by EPA and non-EPA scientists on issues of concern to the Agency.
  - Obtaining a full, documented discussion of the scientific pros, cons, and uncertainties as decisions and policies are developed.
  - Requiring credible, independent peer review of all scientific and technical efforts by ORD and the program and regional offices (including model development and use, data collection and evaluation, monitoring plans, research, technical studies, scoping studies, and assessments).
  - Hosting workshops and meetings on scientific issues for non-EPA as well as EPA scientists, with senior EPA management expected to attend.

- [REDACTED]
3. To be seen as an unbiased source of environmental and health information, EPA needs to make its scientific and technical efforts more widely known. The Agency should develop and implement a coherent communications, outreach, and education plan to publicize the scientific and technical output the Agency is producing for the budget provided. This should be a high-priority team effort on the part of ORD, the Office of Congressional and Legislative Affairs, and the Office of Communications and Public Affairs. The communications materials should be prepared in terms that non-EPA scientists, Congress, and the public can understand. They should describe the short-term research in support of regulation and policy and the long-term anticipatory research performed by EPA laboratories, by other agencies with EPA support, by external commercial contractors, and through university grants and contracts.
  4. EPA's current effort to modify its research planning process should be watched carefully to ensure that it leads to a coherent science agenda and operational plan for science throughout the Agency. The plan should define the year-by-year structural changes and programs needed to implement the Agency's risk-based approach.
  5. The Agency should assemble an anticipatory research program that draws on the expertise of EPA and non-EPA scientists. Such a program will help ensure that EPA does not lose sight of future environmental problems while carrying out its day-to-day activities.
  6. EPA should build its core research program to address comprehensively the following areas:
    - Release, transformation, transport, and fate of materials in the environment, including pathways of exposure for humans and ecosystems.
    - Evaluation of ecological effects on a range of geographic scales (such as local, regional, and global effects).
    - Ecological risk assessment.

**RECOMMENDATIONS**  
(CONTINUED)



- Risk reduction technology research and development.
  - Monitoring and evaluation of environmental trends.
  - Prediction and evaluation of environmental risks to humans.
7. EPA should initiate collaboration with other agencies and the broader scientific community to formulate a joint national strategy for the environment, recognizing that a stronger EPA science base is required for such an initiative. A joint national strategy will allow EPA to exert leadership in identifying current and long-range problems, including those outside EPA's areas of science expertise, and in developing a multi-agency plan.
  8. EPA should consider changing the name of the Office of Research and Development to the Office of Science, Engineering, and Technology to recognize the broader science responsibilities of the Agency.



# The Quality of Science at EPA

The Expert Panel attempted to determine the quality of science obtained and used by EPA. The Panel defined a high-quality science program as one that clearly identifies the most relevant scientific and technical issues; uses the most powerful experimental and analytical designs; employs accurate measurement techniques; evaluates the results with the most appropriate mathematical models; and subjects the methods, results, and interpretations to independent review by a wide variety of experts.

Issues the Panel considered regarding the quality of EPA science included:

- How can the quality of science be ensured?
- To whom should contract or federal scientists be accountable for the quality of their science: scientific leaders or policymakers?
- Is the science provided for decisionmaking at EPA the best available in the scientific community, or only the best available within the EPA community?
- What type of research should be done in house, and what research should be subject to widely advertised open competition?

At EPA, science in support of regulation is performed under contract to the program and regional offices, in ORD laboratories, by contract employees, by external contractors, by external grantees, and through external cooperative agreements. It is in this context that the Panel discussed the above issues and developed its recommendations.



## FINDINGS

1. Science should never be adjusted to fit policy. Yet a perception exists that EPA lacks adequate safeguards to prevent this from occurring.
2. Quality assurance and peer review are essential for ensuring that the best scientific information is used for decisionmaking. EPA requires that its research products undergo peer review, but does not have an Agency-wide policy for *all* science products.

Science activities to support regulatory development—particularly those carried out by the program and regional offices—do not always have adequate, credible quality assurance, quality control, or peer review. Technical studies and data collection efforts, for example, are an important component of science at EPA, and are as important to environmental decisionmaking as scientific and technical research projects. Yet they often lack significant quality assurance and peer review.

In a significant number of instances, EPA receives sound advice from peer review panels. However, this advice is not always heeded. The Agency lacks a system of accountability that actively considers external advice and consciously makes decisions about its applicability and use.

3. EPA, like many other scientific organizations, does not give sufficient attention to validating the models, scientific assumptions, and databases it uses.
4. The present constituency served by EPA science consists primarily of the EPA program offices and regions, not the broad scientific community. In addition, EPA does not regularly consult or sponsor the research of most of the best external scientists working in areas of direct interest to EPA. These problems stem, in part, from the inability of EPA's grants and centers program to interface with the scientific community, given the limited funding available. The many starts and stops in this program have been counterproductive for eliciting the interest and cooperation of scientists outside EPA.
5. The use of large level-of-effort contracts in many parts of the Agency does not promote or ensure the use of high-quality science. The program, regional, and policy offices often use large level-of-effort contracts to conduct technical

studies. Many ORD laboratories have onsite contractors that may provide services beyond basic support functions; scientists employed by contractors sometimes even co-author EPA publications. In these situations, large contracts apparently are used for administrative convenience. The Panel believes that EPA's reliance on these types of contracts for technical expertise prevents EPA from getting the best outside scientists to work on EPA issues. In addition, work performed for EPA through level-of-effort type contracts may not receive adequate quality assurance or peer review.

- RECOMMENDATIONS**
1. The science advice function within EPA—that is, the process of ensuring that policy decisions are informed by a clear understanding of the relevant science—should be enhanced and coherently organized within EPA. The Administrator should appoint a distinguished scientist or engineer to function as EPA's science advisor. This individual could be selected from within or outside EPA. The Panel feels strongly that the Agency needs a science advisor with an appropriate level of support to ensure that credible science for guidance and decisionmaking is available from both EPA scientists and the broader scientific community.

The role of the science advisor would include:

- Ensuring that EPA reaches out to the broader scientific community for information.
- Bridging the potential gap between scientists and decisionmakers within the Agency.
- Being a key player when EPA makes policy decisions. He or she would make sure that, before the Agency makes a decision, it considers the pros, cons, and uncertainties of the science relevant to a policy or regulatory issue.
- Playing a key role in evaluating the professional activities of all EPA scientists as they are considered for awards, promotions, and merit salary increases.

RECOMMENDATIONS  
(CONTINUED)

- Implementing a peer review and quality assurance program (see Recommendation #2 below) for all EPA science-based products, wherever they originate. This would provide accountability for high-quality science throughout EPA and would demonstrate that rigorous peer review is expected for all scientific and technical information used for decisionmaking.
- Developing an appropriate relationship with EPA's Science Advisory Board.

Although the details may differ, the role of the science advisor would be analogous to the role of the General Counsel, who will not release a document destined for an external audience until it is judged legally defensible.

This recommendation could be implemented using one of several different models. In one model, the science advisor would be a strong senior scientist on the Administrator's staff. He or she would provide independent scientific opinions for all policy decisions and would directly influence the Administrator's final decisions. To ensure a relationship of confidence between the science advisor and the Administrator, this individual could be chosen anew by each Administrator. The science advisor would require a small staff and would need access to the science advisory staff of the Assistant Administrators.

In a second model, the science advisor function would be performed by the Agency's science office. This model could be implemented using two different organizational options: (a) The science advisor would be a career scientist in the position of a Deputy Assistant Administrator under the Assistant Administrator for Science, Engineering, and Technology. (ORD would be renamed to acknowledge the Assistant Administrator's responsibility for science throughout the Agency.) (b) Alternatively, the Assistant Administrator for Science, Engineering, and Technology would be the science advisor. He or she would have two Deputy Assistant Administrators, separately responsible

for the science advice function and research operations. Under this model, the science advisor would be in a position to direct scientific resources to address the information needs identified through the science advice process.

Each of these approaches has both advantages and disadvantages.

For example:

- A science advisor on the Administrator's staff would be somewhat removed from scientists in the Agency and would not be able to direct resources to address scientific issues.
- A science advisor who served as a Deputy Assistant Administrator for Science, Engineering, and Technology might have difficulty exercising a strong role on the inner counsels of the Administrator.
- A science advisor who served as the Assistant Administrator for Science, Engineering, and Technology would both manage the research organization and provide objective, independent scientific advice; in some cases, these responsibilities might conflict. For example, a conflict might arise between promoting EPA research products and providing independent opinions on those products.

Ultimately, the model chosen will depend on the capabilities and requirements of the individual who is selected to be EPA's science advisor, as well as the preference of the EPA Administrator.

2. Quality assurance and peer review should be applied to the planning and results of all scientific and technical efforts, including research, technical studies, and data collection, used for guidance or decisions at EPA. EPA's goal should be to provide uniform peer review for the most significant science activities in the Agency. EPA should institute an independent peer review



RECOMMENDATIONS  
(CONTINUED)

program for all its science-dependent products, including those developed by the program and regional offices. The current peer review process in ORD should be reviewed, strengthened, and organized to ensure that *all* in-house and extramural science programs receive timely, credible review.

Peer review and quality assurance should be required at early as well as final stages of an effort. Peer review should be specified in the original study design rather than considered only after the results are obtained. This will ensure that the plans for such products, as well as the results, are scientifically defensible.

3. EPA should give more attention to validating the models, scientific assumptions, and databases it uses.
4. EPA should place a high priority on establishing an effective grants and centers program aimed at enlisting the nation's scientific expertise to address issues of central importance to EPA.
5. EPA should thoroughly review the use of in-house contracts by ORD and level-of-effort contracts by program, regional, and policy offices. The Agency's goal should be to replace many of these contractual approaches with approaches that enlist the best scientific expertise for a given task. For all research, studies, data collection, and other related scientific and technical efforts, EPA should attempt to obtain the best scientists by using widely advertised requests for proposals. EPA should look for ways to improve administrative contracting procedures to facilitate the use of open, competitive contracting by EPA offices and laboratories. The Agency should develop and use explicit criteria for matching a scientific issue to be addressed with the most appropriate research vehicle (such as in-house scientists, university-based researchers, or researchers in other organizations).

# The Quality of Scientists at EPA

The Panel considered a number of issues related to the quality of the individuals at EPA who acquire, develop, and evaluate scientific and technical information. These issues included:

- What is the current quality of scientists at EPA?
- Does EPA provide a supportive environment with sufficient incentives to encourage excellence in science?
- How can EPA attract, nurture, and keep scientists of high quality?

## FINDINGS

1. An inadequate infrastructure and a lack of long-term support have limited EPA to a small number of externally recognized outstanding scientists. The Agency does not yet have the critical mass of such scientists needed to make EPA science generally credible to the broader scientific community.
2. Many EPA scientists do not perform laboratory research, but rather provide technical and regulatory support. The quality of these scientists should be judged by somewhat different criteria than those that apply to research scientists, but in both cases, standards for high-quality science must prevail.
3. EPA provides insufficient incentives to reward the production of high-quality science. The current reward system encourages scientists supporting regulatory development to finish their analyses on time, even if additional time might allow them to produce analyses that are sounder and more credible from a scientific or technical standpoint.

## RECOMMENDATIONS

1. To increase the number of outstanding scientists and engineers in EPA laboratories, the Agency should immediately recruit and make a long-term commitment of support for four to six research scientists and engineers with world-class reputations. These individuals should be national and international leaders in scientific areas vital to the Agency's long-term strategy and direction. They would serve as examples and mentors for all scientists within EPA. They also would bring with them access to networks of world-class scientists, benefiting both younger scientists and EPA as a whole.

These scientists should be designated as special Scholars or Scientists (such as Leopold Scholars, after the pioneering conservationist Aldo Leopold) to provide clear recognition of their status and role. Qualified scientists and engineers currently at EPA *also* should be eligible for recognition as named Scholars or Scientists.

EPA should use a national and international competition with external evaluation to attract these individuals. The Agency should ask the Science Advisory Board to form a search committee and to recommend which disciplines the four to six scientists should represent. The research areas should be ones that are not strong in other agencies, but that are essential to reducing uncertainties in EPA decisionmaking. Examples include:

- Risk reduction methods and technology.
  - Broad-scale ecological effects and risks.
  - Transport and fate of materials, including multi-media pathways of exposure of humans and ecosystems.
  - Cost-effective monitoring on a range of geographic scales.
  - The biological basis for the prediction of health risks.
2. EPA should expand the use of career development paths, such as those in place for research scientists. The Agency should establish a separate science



career track for individuals in the program offices who have appropriate scientific and technical background and who are regularly involved in providing science advice or reviewing science issues and data for regulatory purposes. This track would be analogous to that in place for those providing legal advice (i.e., attorneys in Agency programs). It would include the requirement that the Agency's science advisor approve promotions (see "The Quality of Science at EPA," Recommendation #1). Criteria for a scientist's promotion should include evidence of continuing advancement in his or her discipline, such as completion of coursework, receipt of board certification, or other professional recognition; publications in the relevant scientific literature; and contributions to the work of scientific organizations.

Recommendations from leading non-EPA scientists should also play a significant role in advancement of scientists at EPA. A panel of scientists from universities and other agencies should regularly evaluate the scientific productivity of EPA scientists. This evaluation should be a requirement for promotion of scientists within the Agency.

3. To ensure that EPA scientists are continually exposed to and challenged by current knowledge and methodologies, the Agency should increase scientific contact and openness with other government and private sector organizations, including industry, universities, trade associations, professional societies, and environmental organizations. An example of a successful effort in this area is the Soil Conservation Service's annual Science Day, where hundreds of government scientists gather to network and hear technical reports on the activities of sister agencies.

In addition, the Panel strongly recommends that the Agency expand opportunities for rotations that allow scientists from other organizations to work in EPA's science programs and EPA scientists to participate in the scientific efforts of other organizations. When an EPA scientist rotates to an academic setting, the Agency should expect that he or she will produce peer-reviewed publications. A successful rotation should assist an EPA scientist in obtaining promotions and salary increases. An enhanced rotation program would not only benefit EPA scientists but also promote joint research efforts by EPA with



**RECOMMENDATIONS**  
(CONTINUED)

other scientific organizations. It would improve the Agency's ability to plan and implement scientific studies needed for environmental guidance and decisionmaking. A possible model for a rotation program might be found in Japan, where industry scientists work in government laboratories.

4. EPA should use its reward structure to encourage superior science and science management in the Agency. For example, to qualify for raises and promotions, EPA scientists should be routinely required to prepare papers for peer-reviewed journals and participate in relevant scientific societies in ways that gain recognition for EPA science (for example, through involvement in the conduct of meetings or governance of organizations). To support these activities and enhance the Agency's scientific environment, EPA must minimize its scientists' bureaucratic duties and ensure that they spend a significant percentage of their time on scientific activities. In addition, EPA should develop competitive compensation packages allotted on the basis of comparison with the best of one's peers.

# How the Budget Process Affects Science at EPA

The Panel addressed the issue of how EPA's research and science budget affects the numbers and types of scientists at EPA, as well as the quality of the science the Agency undertakes. Key questions considered by the Panel included:

- How does the budget process affect the quality of science at EPA?
- Does the budget process discourage long-term strategic planning for high-risk/high-return research?
- Does the budget process hinder EPA in conducting anticipatory research to identify environmental problems before they become critical?
- Should a long-term, anticipatory research budget be separated from a short-term research and development budget?

## FINDINGS

1. Finding solutions to today's increasingly complex environmental problems requires a greater emphasis on a cross-media approach. EPA's budget, however, does not adequately reflect this fact. The current budget process is an obstacle to formulating and carrying out a coherent science strategy. Currently, the yearly budget process for ORD is governed by a media-specific approach that extends from within the Agency to the Office of Management and Budget (OMB) and Congress. The process places an undue emphasis on media-specific endpoints, to the detriment of science related to important cross-media environmental problems.
2. Congress, OMB, and others currently do not understand the strategic direction EPA wishes to pursue in environmental science. EPA, in turn, cannot present Congress with a rational argument for an appropriate funding level

FINDINGS  
(CONTINUED)

for science without first developing a coherent strategic plan for its science efforts.

3. EPA science programs currently are unable to carry out prolonged research or anticipate future information needs. This is true for two reasons: first, the Agency is not yet looking far enough ahead to be able to anticipate emerging environmental problems; second, EPA's science programs are not structured to allow for the continuity of funding needed to pursue long-term issues. The current budget process makes it difficult, if not impossible, to ensure continuity of funding for the long-term, anticipatory research and assessment that are essential to reducing uncertainty in future decisionmaking. These long-term needs are often preempted by short-term deadlines, leaving EPA and the nation unprepared for later problems.
4. ORD's contribution to the technical support of regulations does not receive the recognition it deserves, because these activities are not identified separately from other science activities in the research budget.
5. Scientists outside EPA regard EPA contracts as the least desirable funding mechanisms among those of all federal agencies because of inconsistencies in direction and lack of funding continuity. These problems are imposed primarily by the budget process. The consequences to the Agency are enormous, because many of the nation's best scientists are deterred from becoming involved in scientific efforts of importance to EPA.

RECOMMENDATIONS

1. A comprehensive, long-term scientific strategy should drive annual budget decisions concerning EPA science. EPA should continue and strengthen its current strategic issue planning process. Goals of the planning process should include developing clear objectives and obtaining continuity in funding.
2. EPA should place greater emphasis on cross-media planning and scientific efforts, with the aim of examining all the effects of environmental processes across all media. The Agency's environmental research program should have a large cross-media component that defines the scientific activities required to support the Agency's mission. A scientific understanding of cross-media



effects ultimately will result in a more coherent effort by the Agency to address cross-media problems.

This new emphasis will require enhanced cross-media budgeting. EPA's presentation of its research programs to OMB should reflect a cross-media perspective rather than a perspective that fragments environmental protection into different media.

3. EPA needs to clearly define the mission of each of its laboratories. When laboratories collaborate on a topic, the Agency needs to determine how each laboratory will organize and discharge its responsibilities. EPA must provide the laboratories with the consistent support they require to accomplish their missions.
4. EPA's budget must include long-term funding and support for anticipatory scientific studies. The importance of these studies must be explained to Congress and OMB so that, over the next few years, a portion of the Agency's budget can be directed to critical future problems. EPA then can shift resources to critical issues as they are discovered and mitigate their potential impact.
5. EPA should use its budget to obtain the best possible scientific information and ensure that the nation's scientific expertise is enlisted in the service of EPA's mission. EPA should use the full suite of mechanisms available to achieve these goals, including grants and centers, contracts, and cooperative agreements.



## How EPA Uses Science in Decisionmaking

**E**PA needs to obtain the best up-to-date, objective scientific and technical information for decisionmaking. Equally important is how the Agency applies that information to make credible decisions. The Panel addressed several questions regarding how the Agency uses science in decisionmaking:

- What is the role of science in the development of regulations and policy? How is science represented in the decisionmaking process?
- Is university and industry science adequately identified and used by EPA?
- At what stages in the decisionmaking process should science input from non-EPA sources be available? Should the entire process of using science in decisionmaking be more open?
- How can reputable scientific views, irrespective of the policies being considered, be fairly represented and assessed in all reports?
- How can science enter the decisionmaking process along with political pressures and input from special interest groups and still maintain its integrity?

### FINDINGS

1. EPA should be a source of unbiased scientific information. However, EPA has not always ensured that contrasting, reputable scientific views are well-explored and well-documented from the beginning to the end of the regulatory process. In addition, the Agency is perceived to have a conflict of interest because it needs science to support its legal activities. The legal process fosters the presentation of the extremes of scientific opinion. This runs contrary to the preferred process of developing a consensus within the scientific community.

2. EPA science is *perceived* by many people, both inside and outside the Agency, to be adjusted to fit policy. Such "adjustments" could be made consciously or unconsciously by the scientist or the decisionmaker.
3. While the public frequently expects immediate "yes or no" answers to questions about environmental risks, scientific uncertainties often make such answers elusive. EPA has not been successful in communicating to Congress and the public about the nature of uncertainties in science and how these uncertainties are handled when decisions are made.
4. EPA program offices often conduct scoping studies or other preliminary assessments in the early stages of regulatory development. These studies are frequently carried out without the benefit of peer review or quality assurance. They sometimes escalate into regulatory proposals with no further science input, leaving EPA initiatives on shaky scientific ground and affecting the credibility of the Agency.
5. EPA often does not scientifically evaluate the impact of its regulations. The implementation of an environmental policy or regulation provides a unique opportunity to study the environmental response to changes in the type and amount of pollutants. It also represents the best time to begin evaluating the effectiveness of a regulation or policy.

The importance of evaluating the effectiveness of regulations is demonstrated by the way EPA has regulated primary air pollutants. The Clean Air Act mandates that EPA review the primary air quality standards every five years. While this schedule has not been met, the scientific basis for the regulation of each of these agents has improved as a result of periodic reviews. In the case of particulates, researchers have learned that small particulates that are easily breathed into the lungs are mainly responsible for adverse health effects. This knowledge has allowed EPA to replace the ineffective standard for total suspended particulates and the emphasis on technological approaches aimed at only the heavier particulates.

6. The interpretation and use of science is uneven and haphazard across programs and issues at EPA. Conflicting science policies between EPA programs create confusion and a lack of credibility for EPA decisions.



7. Scientists at all levels throughout EPA believe that the Agency does not use their science effectively.

## RECOMMENDATIONS

1. The climate and culture within EPA should emphasize that science should never be adjusted to fit policy, either consciously or unconsciously. For example, the Agency must promote an atmosphere of open discussion in which the scientific staff feels free to express conflicting opinions and judgments without fear of reprisals.
2. To ensure that unbiased information is used to support decisionmaking, EPA must be open to all scientific views and should develop mechanisms for obtaining the consensus of the scientific community. In regulatory development, EPA should implement a widely advertised, open process whereby the scientific views of all parties are heard prior to regulatory decisions. The results of these discussions should be conveyed to EPA decisionmakers.

A successful model for this open process is the Clean Air Scientific Advisory Committee of EPA's Science Advisory Board. This committee has consistently provided an open forum for review and discussion of the science underlying EPA's national ambient air quality standards. Consequently, this committee is well-respected by scientific experts in the field.

3. EPA should implement a decisionmaking process whereby science advice is provided as early as possible, beginning in the problem identification and scoping phase and continuing throughout the development of policy, regulations, and nonregulatory strategies.

To support this effort, EPA should examine how the Agency used science in the past in developing one or more major regulations. The goal of such a study would be to determine the type of scientific and technical information needed for decisionmaking and the points at which scientific input is most effective. This analysis may help the Agency identify places in the regulatory process where science input is needed but was not included in previous regulatory efforts. The study should take into account the varying needs and decisionmaking processes of the different EPA program offices.



# Appendix A

## Strategic Direction for the U.S. Environmental Protection Agency *"EPA... Preserving Our Future Today"*

### MISSION

The people who work at the Environmental Protection Agency are dedicated to improving and preserving the quality of the environment, both national and global. We work to protect human health and the productivity of natural resources on which all human activity depends. Highly skilled and culturally diverse, we are committed to using quality management processes that encourage teamwork and promote innovative and effective solutions to environmental problems. In particular, we are committed to ensuring that:

- Federal environmental laws are implemented and enforced effectively.
- U.S. policy, both foreign and domestic, fosters the integration of economic development and environmental protection so that economic growth can be sustained over the long term.
- Public and private decisions affecting energy, transportation, agriculture, industry, international trade, and natural resources fully integrate considerations of environmental quality.
- National efforts to reduce environmental risk are based on the best available scientific information communicated clearly to the public.
- Everyone in our society recognizes the value of preventing pollution before it is created.
- People have the information and incentives they need to make environmentally responsible choices in their daily lives.

## GOALS AND OBJECTIVES

- Schools and community institutions promote environmental stewardship as a national ethic.

**E**PA's unique role in protecting the environment includes:

- Providing leadership in the nation's environmental science, research, and assessment efforts. We are committed to:
  - Gathering and analyzing the data needed to evaluate environmental risks and trends, measure environmental results, and inform the choices of institutions and individuals throughout society;
  - Promoting and supporting innovative technological solutions to environmental problems;
  - Encouraging and conducting research that improves our understanding of health and ecological risks;
  - Providing objective, reliable, and understandable information that helps build trust in EPA's judgment and actions; and
  - Sharing research findings and innovative technologies with other nations.
- Making sound regulatory and program decisions. We are committed to:
  - Implementing current environmental laws effectively, and helping to improve those laws as they are reauthorized in the future;
  - Evaluating health and ecological risks, and targeting our environmental protection resources at

the problems and the geographical areas posing the greatest risks;

- Promoting public and private actions that prevent pollution at the source before it becomes a problem;
  - Protecting the environment as a whole by developing programs that control the movement of pollutants across environmental media;
  - Devising innovative, integrated solutions to environmental problems, especially when they are concentrated in specific geographic areas or industries;
  - Improving the economic analyses that promote efficiency and cost-effectiveness in our decisions;
  - Applying market mechanisms and economic incentives when they are appropriate and effective; and
  - Working with other government agencies to ensure they consider the environmental implications of their actions.
- Effectively carrying out our programs and policies. We are committed to:
    - Meeting federal statutory obligations while retaining sufficient flexibility to address priority risks in different parts of the country;
    - Maintaining a vigorous and credible enforcement program, with emphasis on multi-media and criminal violations;
    - Promoting cross-media and interstate initiatives, such as multi-media permitting and enforcement;

GOALS AND  
OBJECTIVES  
(CONTINUED)

- 
- Enabling state and local governments, as partners, to implement and enforce environmental programs;
  - Conveying clear, accurate, and timely information to the public, and incorporating information from the public in EPA activities; and
  - Involving other government agencies, public interest groups, the regulated community, and the general public in achieving national and global environmental goals.
- Improving the global environment. We are committed to:
    - Maintaining and strengthening U.S. leadership to protect and improve the global commons;
    - Working with other government agencies and nations, the private sector, and public interest groups to identify and solve transboundary pollution problems;
    - Ensuring that environmental concerns are integrated into U.S. foreign policy, including trade, economic development, and other policies; and
    - Providing technical assistance, new technology, and scientific expertise to other nations.

April 1991

# Appendix B

## Charge to the Expert Panel and Affiliations of Panel Members

*U.S. Environmental Protection Agency  
Charge to the Expert Panel on the Role of Science at EPA  
May 22, 1991*

### PURPOSE OF THE REVIEW

The Agency's new statement of strategic direction calls for sound science serving as the foundation for the Agency's policy and program decisions. The Administrator of EPA is establishing an Expert Panel to advise him on how best to achieve the objectives set forth below. The Administrator has asked the Panel to work with the Assistant Administrator for the Office of Research and Development (ORD) and other EPA offices to accomplish this task. The Administrator has also asked the program Assistant Administrators to cooperate fully in this endeavor.

### OBJECTIVES

- To identify how best to provide the Administrator with up-to-date, objective scientific information in keeping with the new strategic direction.
- To assure that the knowledge base necessary to achieve the new vision is available through proper planning, adequate resources, and necessary leadership.
- To ensure that the research and scientific information needs of the programs and regions are adequately met and their views incorporated in the scientific advice provided to the Administrator.



## Appendix C

### Persons Interviewed By the Expert Panel

Name	Affiliation
Alvin L. Alm	Director and Senior Vice President, Science Application International Corporation
D. Allan Bromley	President's Science Advisor
J. Clarence Davies	Executive Director, National Commission of the Environment, Conservation Foundation
Paul M. Deisler, Jr.	Vice President for Health, Safety, and Environment (retired), Shell Oil Company
Allan M. Ford	Member, Committee on Environmental Improvement, American Chemical Society
David M. Gibbons	Deputy Associate Director for Natural Resources, Office of Management and Budget
George M. Hidy	Vice President for Environment, Electric Power Research Institute
Gene E. Likens	Director, Institute of Ecosystem Studies
Margaret G. Mellon	Director, Biotechnology Project, National Wildlife Federation
Dallas L. Peck	Director, U.S. Geological Survey
Jimmie R. Powell	Professional Staff Member, Senate Environment and Public Works Committee
Walter R. Quanstrom	Vice President, Environmental Affairs and Safety, Amoco Corporation

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- To assure that the knowledge base necessary to achieve the new vision is available through proper planning, adequate resources, and necessary leadership.
- To ensure that the research and scientific information needs of the programs and regions are adequately met and their views incorporated in the scientific advice provided to the Administrator.



- To enhance the stature of science within the Agency and among the many constituencies with which EPA deals.

#### CHARGE TO THE EXPERT PANEL

By the end of September 1991, provide to the Administrator a set of recommendations for achieving EPA science objectives. Among the specific issues the Panel should consider:

- How can the role of ORD and its significant resources be enhanced to help fulfill these objectives?
- How should other organizational components of EPA that carry out scientific work help assure overall quality of science across the Agency?
- How can organizational elements that collect, store, manage, and interpret Agency data help ensure the integrity and interpretive quality of environmental data? Are changes needed in cross-media data systems or programs—e.g., the proposed Center for Environmental Statistics?
- How should EPA decisionmaking processes be modified to ensure that regulatory policies are consistent with the current state of science? How can EPA ensure that the new emphasis on nonregulatory approaches to environmental problems will be based on a sound scientific foundation?
- How should current and planned science resources be allocated to improve the scientific basis for EPA decisionmaking?
- How can EPA ensure that research is focused on the highest priority environmental problems and

anticipates the future information needs of EPA programs? How can advances in scientific understanding be incorporated into the Agency's research programs and priorities?

- How can the stature and reputation of science in the Agency be improved?
- How can EPA leverage the work of other federal agencies and scientific institutions? How can EPA work most effectively in the international scientific community?

## COMPOSITION OF THE PANEL

Raymond C. Loehr (Chair of the Panel)  
H.M. Alharthy Centennial Chair in Civil Engineering  
Department of Civil Engineering  
University of Texas

Bernard Goldstein, M.D.  
Professor and Chairman, Department of Environmental and  
Community Medicine  
Director, Environmental and Occupational Health Sciences Institute  
University of Medicine and Dentistry of New Jersey—Robert Wood Johnson  
Medical School

Paul G. Risser  
Provost and Vice President for Academic Affairs  
University of New Mexico

Anil Nerode  
Professor of Mathematics and Computer Science  
Goldwin Smith Chair and Director, Mathematical Sciences Institute  
Cornell University



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Allan M. Ford	Member, Committee on Environmental Improvement, American Chemical Society
David M. Gibbons	Deputy Associate Director for Natural Resources, Office of Management and Budget
George M. Hidy	Vice President for Environment, Electric Power Research Institute
Gene E. Likens	Director, Institute of Ecosystem Studies
Margaret G. Mellon	Director, Biotechnology Project, National Wildlife Federation
Dallas L. Peck	Director, U.S. Geological Survey
Jimmie R. Powell	Professional Staff Member, Senate Environment and Public Works Committee
Walter R. Quanstrom	Vice President, Environmental Affairs and Safety, Amoc Corporation

Michael L. Rodemeyer Chief Counsel, House Science, Space and Technology  
Committee

David P. Rall Former Director, National Institute for Environmental  
Health Sciences

Terry F. Yosie Vice President, Health and the Environment, American  
Petroleum Institute

Frank E. Young Deputy Assistant Secretary for Health/Science and  
Environment, U.S. Department of Health and Human Services

Donald G. Barnes Director, Science Advisory Board

EPA  
Erich W. Bretthauer Assistant Administrator, Office of Research and  
Development

Don R. Clay Assistant Administrator, Office of Solid Waste and  
Emergency Response

Thomas P. Dunne Associate Administrator, Office of Regional Operations  
and State/Local Relations

Lester D. Grant Director, Environmental Criteria and Assessment Office -  
Research Triangle Park

Edward J. Hanley Deputy Assistant Administrator, Office of Administration  
and Resources Management

Victor J. Kimm Deputy Assistant Administrator, Office of Pesticides and  
Toxic Substances

Richard D. Morgenstern Acting Assistant Administrator, Office of Policy, Planning  
and Evaluation

Thomas A. Murphy Director, Environmental Research Laboratory - Corvallis



EPA  
(CONTINUED)

Dorothy E. Patton	Director, Risk Assessment Forum
Peter W. Preuss	Director, Office of Technology Transfer and Regulatory Support, ORD
Frank T. Princiotta	Director, Air and Energy Engineering Research Laboratory Research Triangle Park
Courtney Riordan	Director, Office of Environmental Processes and Effects Research, ORD
William G. Rosenberg	Assistant Administrator, Office of Air and Radiation
Michael H. Shapiro	Deputy Assistant Administrator, Office of Air and Radiation

# Appendix D

## Record of Public Meeting Attendance and Written Comments

MEMBERS OF THE  
PUBLIC ATTENDING  
EXPERT PANEL  
PUBLIC MEETINGS

*July 24, 1991*

Lisa L. Barrera  
Ted N. Barrera  
Mark Benjamin  
Robert Carton  
Patrick Davies  
W. Gary Flamm  
Paul Garvin  
Andrew W. Kaupert  
Nora L. Lee  
Soonie McDavid  
Resha M. Putzrath  
Anne Santalla  
Susan Turner

Barrera Associates, Inc.  
Barrera Associates, Inc.  
Environmental Policy Center  
National Federation of Federal Employees  
Covinston & Burling  
Flamm Associates  
Amoco Corporation  
General Motors  
Health and Environmental Science Group  
Chemical Specialities Manufacturers  
Organization Resources Counselors, Inc.  
American Industrial Health Council  
American Chemical Society

*July 25, 1991*

Ted N. Barrera  
Mark Benjamin  
James Jones  
Andrew W. Kaupert  
Nora L. Lee  
Anne Santalla  
Robin Sudja  
James D. Wilson

Barrera Associates, Inc.  
Environmental Policy Center  
*Inside EPA*  
General Motors  
Health and Environmental Science Group  
American Industrial Health Council  
Distilled Spirits Council of U.S.  
Monsanto Co., St. Louis, MO

MEMBERS OF THE  
PUBLIC ATTENDING  
EXPERT PANEL  
PUBLIC MEETINGS  
(CONTINUED)

*August 19, 1991*

Ted N. Barrera  
Keith Belton  
Peter J. Camp  
Robert Carton  
Sanford Cohen  
Joanne Goodell  
Rich Jarman  
James Jones  
Andrew W. Kaupert  
Allison Keeler  
Nora L. Lee  
Barry Page  
Steve Riser  
Anne Santalla  
Bruce K. Trauben  
Susan Turner  
Dennis Wamsted  
Pat Ware

Barrera Associates, Inc.  
American Chemical Society  
4100 Massachusetts Ave., NW, #314, Washington, DC  
National Federation of Federal Employees  
SC&A  
OSHA Policy Directorate  
NFPA  
*Inside EPA*  
General Motors  
Environmental Policy Center  
Health and Environmental Science Group  
HIMA  
Business Publishers Inc. (*Toxic Materials News*)  
American Industrial Health Council  
700 13th St., NW, Suite 700, Washington, DC 20005  
American Chemical Society  
*Environment Week*  
*BNA - Environment Reporter*

INDIVIDUALS WHO  
PROVIDED WRITTEN  
COMMENTS

Jeff Barnett	EPA Region 3
Mary Ann Boyer	EPA Region 3
Dr. Robert J. Carton	Senior Vice President, National Federation of Federal Employees
Al Cimorelli	EPA Region 3
Robert Courson	Director, Environmental Services Division, EPA Region 10
Jeffery Denit	Deputy Office Director, EPA Office of Solid Waste
Gerard F. Egan	Chair, Scientific Committee, American Industrial Health Council
Edwin B. Erickson	Regional Administrator, EPA Region 6
Larry E. Erickson	Professor and Director, Center for Hazardous Substance Research, Kansas State University
Debra Forman	EPA Region 3
Robert J. Gnaedinger, Jr.	Chemist, EPA Region 5
Susan C. Gordon	Assistant Regional Administrator, EPA Region 7
Terry Harvey	Director, Environmental Criteria and Assessment Office, Office of Research and Development
Nike J. Horoszewicz	Environmental Protection Specialist, EPA Region 5
Morris Kay	Regional Administrator, EPA Region 7
Arnold Kuzmack	Senior Science Advisor, EPA Office of Science and Technology, Office of Water
Robert Layton	Regional Administrator, EPA Region 6
Dominique Lueckenhoff	National Chair, EPA Women in Science and Engineering (WISE)
Suzanne Lussier	Regional Scientist, EPA Region 3
Bill Muir	EPA Region 3
Richard Nagle	Assistant Regional Counsel, EPA Region 5
Ron Preston	EPA Region 3
Resha M. Putzrath	Organization Resources Counselors, Inc.
Charlie Rhodes	EPA Region 3
Arthur Spingarn	EPA Region 3
Neil Swanson	EPA Region 3
Orterio Villa	EPA Region 3



**A**dditional copies of this report may be obtained  
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