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AN SAB REPORT: REVIEW OF 14 STRATEGIC ORD RESEARCH ISSUES FOR FY 1994

REVIEW BY THE RESEACH STRATEGIES ADVISORY COMMITTEE OF NEW PLANNING SYSTEM ISSUE STRATEGIES FOR FY 1994

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

EPA-SAB-RSAC-92-022

July 28, 1992

OFFICE OF
THE ADMINISTRATOR

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

Subject: Review of FY 1994 Strategic Research Issues

Dear Mr. Reilly:

The Research Strategies Advisory Committee of EPA's Science Advisory Board (SAB) met on February 28, 1992, to review 14 of 39 FY 1994 strategic research issues for Research and Development activities within the Agency. This review was held to provide the Agency with insights on the scientific quality and responsiveness of the new format for Agency research proposals. The Subcommittee attempted to provide a critical look at specific activities outlined in each submission. To achieve this goal, representatives were selected from each of the various committees of the SAB. These individuals provided a broad spectrum of scientific expertise from which to draw the conclusions found in this report.

The Committee notes that this document is the Agency's first attempt to tie research programs to broad issues and that the attempt is laudatory, despite specific criticisms offered at the meeting and/or listed below. This approach to research planning offers hope for increased productivity, relevance and scientific quality in the future. This orientation of research toward issues and greater integration of divergent research efforts (by relating activities to issues) will result in an improved, more effective overall strategic and a more comprehensible research program. This will result in benefits to the Agency, the country and the environment.

The Committee is also pleased to note that there is considerable evidence of the influence of both the Future Risk (EPA-SAB-EC-88-044) and in particular, the Reducing Risk (EPA-SAB-EC-90-021) reports in the draft

documents—however, we regret to note that budgetary recommendations of the Future Risk report have not been adopted in practice. And, while the concept of relative risk ranking is used in a number of instances, the document does not elaborate on the significance of relative risk, i.e., how relative risk should be related to research efforts, and how to improve the relative risk ranking efforts themselves. For example, the text of the review documents is not a sufficient definition of the concept of "Ecological Risk" even though the Committee is aware of the extensive effort being made to address this issue (cf., the Risk Assessment Forum's work and the SAB's Ecological Processes and Effects Committee's (EPEC's) review thereof). Thus, the subject is open to ambiguity that obscures the rationale provided for research that is driven by ecological concerns. We trust that this situation will be addressed and clarified in future years.

Committee members also voiced numerous concerns about abandoning discipline-based tracking of activities and resources. The members felt strongly that dual accountability would add additional insights into the program and urge the Agency to crosswalk activities and associated resources into formats by issue and office (media and discipline).

In conclusion, the Committee is pleased with the overall approach which ORD is taking in planning its research activities. Linking environmental R&D with broad issues enhances the Agency's ability to undertake responsive efforts and develop sound regulatory decisions. Still, the brevity of most of the documents preclude an in-depth assessment. In most cases, it was not possible to couple stated goals of the planned research with the related financial commitment.

The Committee thanks you for the opportunity to again participate in this review and looks forward to your response to the recommendations contained in the report.

Mr. Alvin Alm, Chairman
Research Strategies Advisory Committee

Dr. Raymond Loehr, Chairman
Science Advisory Board

Enclosure

NOTICE

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

ABSTRACT

The Office of Research and Development has implemented a new issue based planning system for environmental research. This approach to R&D planning holds promise for research programs. Each of the 14 "issue strategy" documents (Nonpoint Source Pollution, Indoor Air Pollution, Health Risk Assessment Methods, Environmental Education and Outreach, Anticipatory Research, Exploratory Grants and Centers, Drinking Water Pollutants and Disinfectants, Terrestrial Systems, Habitat/Biodiversity, Wetlands, Environmental Monitoring and Assessment Program (EMAP), Global Warming Environmental Releases of Biotechnology Products, and Bioremediation) provided a brief description of the topic, future activities in the area, and high/low resource scenarios. The Committee views the process as an excellent start for future planning cycles.

key words: issue strategy, planning, research

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1.0 EXECUTIVE SUMMARY

On February 28, 1992, the U.S. Environmental Protection Agency's Science Advisory Board's (SAB) Research Strategies Advisory Committee met to review a subset of EPA's Research Issue Strategies developed by the Office of Research and Development for FY 1994. This report offers detailed comments on the documents, which varied in length from one to three pages and included:

- Nonpoint Source Pollution
- Indoor Air Pollution
- Health Risk Assessment Method
- Environmental Education & Outreach
- Anticipatory Research
- Exploratory Grants and Centers
- Drinking Water Pollutants and Disinfectants
- Terrestrial Systems
- Habitat/Biodiversity
- Wetlands
- Environmental Monitoring & Assessment Program
- Global Warming
- Environmental Releases of Biotechnology Products
- Bioremediation

In general, the Committee was pleased with the approach which ORD is taking in planning its research activities. Linking environmental R&D with broad issues enhances the Agency's ability to undertake responsive efforts and develop sound regulatory decisions. Still, the brevity of most of the documents preclude an in-depth assessment. In most cases, it was not possible to couple stated goals of the planned research with the related financial commitment. Additionally, the panelists voiced numerous concerns about abandoning discipline-based tracking of activities and resources. The members felt strongly that dual accountability would add additional insights into the program.

2.0 INTRODUCTION

2.1 Background

The Research Strategies Advisory Committee (RSAC) of the Science Advisory Board (SAB) was asked to review the FY 1994 Strategic Research Issues proposed by EPA's Office of Research and Development (ORD). RSAC was provided with 39 ORD strategy issue statements (1-3 pages long), describing strategies for addressing each of the specific environmental problems. The RSAC members chose to examine thoroughly a subset of 14 issues, which were divided between two workgroups of panelists. Workgroup A (moderated by M. Lippmann, with RSAC members R. Hartung, P. Deisler, and R. Bull) considered seven issues:

Nonpoint Source Pollution
Indoor Air Pollution
Health Risk Assessment Methods
Environmental Education and Outreach
Anticipatory Research
Exploratory Grants and Centers
Drinking Water Pollutants and Disinfectants

Workgroup B (moderated by D. Premo, with RSAC members J. Neuhold, D. Boesch, and R. Conway) considered seven different issues:

Terrestrial Systems
Habitat/Biodiversity
Wetlands
Environmental Monitoring and Assessment Program (EMAP)
Global Warming
Environmental Releases of Biotechnology Products
Bioremediation

Many review comments were conveyed verbally to the Agency during a meeting held on February 28, 1992. This SAB report integrates and presents the comments of the two Workgroups. Section 2.0 provides the charge to the SAB for this review, and the Committee's general response. Section 3.0 contains the detailed response of the Committee to the health-oriented strategic issues, while Section 4.0 contains the detailed responses to the ecologically-oriented issues. The Appendix contains Dr. Bull's more specific comments on general issues and concerns about researching Drinking Water and the Ground Water issues.

2.2 Charge and General Response

The charge to the Research Strategies Advisory Committee was to evaluate the strategic research issue descriptions according to:

- The adequacy of the strategic direction provided for each proposal.
- The relationship between short- and long-term efforts.
- The integration of such efforts with similar activities elsewhere, both within and outside of the EPA.

The Committee notes that this document is the Agency's first attempt to tie research programs to broad issues and that the attempt is laudatory, despite various specific criticisms offered at the meeting and/or listed below. This approach to research planning offers hope for increased productivity, relevance and scientific quality in the future. This orientation of research toward issues and greater integration of divergent research efforts (by relating activities to issues) will result in an improved, more effective overall strategic and a more comprehensible research program. This will result in benefits to the Agency, the country and the environment.

The Committee is also pleased to note that there is considerable evidence of the influence of both the Future Risk and in particular, the Reducing Risk reports in the draft documents—although budgetary recommendations of the Future Risk report have not been adopted in practice. And, while the concept of relative risk ranking is used in a number of instances, the document does not elaborate on the significance of relative risk, i.e., how relative risk should be related to research efforts, and how to improve the relative risk ranking efforts themselves. For example, the strategy text in the ecology sections does not sufficiently define the concept of "Ecological Risk" even though the Committee is aware of the extensive effort being made to address this issue (cf., the Risk Assessment Forum's work and the SAB's Ecological Processes and Effects Committee's (EPEC's) review thereof). Still, the subject is open to ambiguity that obscures the rationale provided for research that is driven by ecological concerns. We trust that this situation will be addressed and clarified in future years.

2.3 General Comments of the Strategy Documents

SPECIFIC CHARGE #1: Adequacy of strategic direction

As noted above, this is a good first step in a new approach to research management. However, as expected, there are many places for improvement. For example, it would be appropriate to develop an introductory synopsis of the overall strategic plan for ORD efforts, thereby providing a setting and background for understanding each individual issue and identifying its place in the overall strategy.

In general, the issue statements do not provide consistent and adequate bases for research direction. While some of the strategies were adequately developed, others lacked a clear sense of direction (See details below.). The Committee trusts that greater uniformity and improved overall quality will result as the Agency becomes more experienced with this improved approach to research planning.

The Committee recommends development of more meaningful levels of effort associated with the issue statements. In this regard, an indication of total projected levels effort and distribution among various disciplines would elicit more useful comments from the SAB at early stages of planning. One such device which was extremely useful was included in the issue statements. This section gave a sense of priority by describing "scenarios"which presented what would be done if more funds were available and, conversely, what would be cut if funds were curtailed. This approach was especially useful in discussing the exploratory grants and center programs.

SPECIFIC CHARGE #2: Balance between short- and long-term efforts

In most instances little information was provided specifically relating short- and long-term efforts. The focus was essentially on the totality of the program and its associated effort for the next several years. In most instances, graphics projecting expenditures gave an indication of the rate (and distribution) of expenditure of effort contemplated, although programmatic relationships were not often specifically addressed.

SPECIFIC CHARGE #3: Integration of research efforts

In some cases mention was made of programs within EPA that are related to programs of other agencies. However, the extent and mechanism of integration between EPA and other such organizations could not be easily determined from the descriptions provided. Within the Agency, programs dealing with similar or related matters were rarely noted. Furthermore, there was no obvious effort at integration across (within) the Agency even though there appeared to be many opportunities for such integration. For example, possible relationships between different ecological research programs and the Environmental Monitoring and Assessment

Program (EMAP) could have been described, but were not. The Committee urges that such analysis be a component of future strategies.

Also, there is good reason not to abandon tracking research programs according to media as those relate better to disciplines (skills) and regulatory considerations. Ideally, a dual categorization by issues and media would be more effective than either alone.

3.0 HEALTH RELATED STRATEGIC ISSUES

3.1 Nonpoint Sources

The Committee feels that this issue strategy provides a good overview and adequately reflects EPA's role in the larger national effort to address a critical environmental issue. While inter and intragency cooperation/ coordinators are evident, it is clear that current national efforts concentrate on selected problem areas such as midwestern agriculture. Therefore, the Committee points out that a truly national effort to adequately address this problem will require considerably more funding.

3.2 Indoor Air

This issue was addressed as three sub-issues by the Committee: indoor air, radon, and electromagnetic fields.

With regard to indoor air, emphasis is placed on those indoor pollutant sources and exposures that cause neurotoxicity, irritation and other non-cancer health effects (with a focus on organic vapors, their combinations, and bioaerosols). Other indoor pollutants with potentially significant health effects are, therefore, judged to be less critically important (e. g., environmental tobacco smoke especially respiratory effects in children, asbestos and its fibrous substitutes, and combustion effluents from nonvented sources). The Committee recommends that related carcinogenic effects will not be consciously ignored during these investigations, and also recommends that bioaerosols and organic vapors warrant more research; (cf., the production of volatile by-products and the production of irritating compounds possibly aldehydes and aerosols by alternate methods of drinking water disinfection).

There is also some concern about whether productive clinical research on individual organic vapors would be feasible, or whether the areas of emphasis selected were really the most important in terms of reducing the risks of indoor pollutant exposures. However, it is a consensus that projected funding levels will not permit appropriate levels of research for more than one or two pollutant classes.

With regard to radon, the Committee feels that the focus on mitigation research is appropriate and the program is on track. The inclusion of EMF however, was questioned since some of the exposures of greatest concern occur outdoors, though possible interactions of other agents and EMF cannot be ignored in any setting.

Coordination of research efforts in each of these areas seems to have been

established with DOE. With regard to indoor air in particular, lines of communication within EPA and between EPA and NIOSH, DOE, CPSC, and HUD, seem to be adequate to avoid duplicative efforts. This is particularly important since some aspects of the strategy seem to focus on areas outside of, or only marginally related to, EPA's mission and fall into NIOSH and OSHA areas of responsibility (e.g., the issue of sick building syndrome).

3.3 Health Risk Assessment Methods

Strategic direction of this ambitious and important initiative is sound, but the pace of research and funding levels are not commensurate with needs and opportunities. Improved risk assessment methods could facilitate the identification of critical research needs and thereby improve the research planning process. Increased levels of activity in this area could also save time and money for ORD in the long run by providing a sounder basis for each successive budget plan.

The Committee gained the impression that the strategy is directed at individual chemical risks and comparisons between those risks that are manifested through similar mechanisms. While useful and possibly more tractable, this approach should be supplemented by other efforts to compare risks of different types (that is, human health risks—or loss of well being risks—risks as they might be caused by ecological effects risks vs. other direct human health effects risks).

Integration activities described in this issue strategy seem to be generally adequate, and the balance between short- and long-term investigations appears to be generally sound. However, some effort needs to be expended on the more difficult issues mentioned in the previous paragraph if EPA is to generate adequate solutions in the future.

3.4 Environmental Education and Outreach

The RSAC panel found this issue difficult to review. It does not address research needs, and its education activities are largely focused at the K-12 level where the panel members have little background or experience. ORD should more closely coordinate with the Agency's Office of Environmental Education to consider the needs and prospects for research on effective means of addressing environmental educational requirements for students at the K-12 level. Also, the Committee regrets that the program fails to address critical needs for graduate and post-graduate training in the environmental engineering, science, and health disciplines. The people trained in programs formerly supported by EPA and its predecessor agencies are aging, and not being replaced by younger professionals with comparable training

and up-to-date skills. One exception is the program to train under represented minorities. However, this program cannot, by itself, meet the critical needs of the environmental research community.

The environmental education and outreach programs at EPA headquarters, laboratories, and regional offices appear to be well integrated. Still, it is clear that a greater degree of integration is needed with NSF programs and with the recently initiated efforts of NIEHS in this area.

3.5 Anticipatory Research

The strategic goals and directions of this new program appear to be generally appropriate and are certainly promising. Still, there are several aspects of these efforts which remain unclear at this juncture. For example, at what level within the organization will it operate?. Will it be utilized to seek out really new environmental problems, or will it simply develop issues that are already known within the Agency? The projects mentioned in the issue statement are all important, but in nearly all cases represent problems that have been recognized as important for more than 20 years. The Agency needs to develop some approach to identifying problems that are truly unknown at this time. The SAB has provided ideas along this line in Future Risk . The issue of environmental equity mentioned here appears to be a somewhat separate activity. It is therefore unclear how fully or how well this sub-issue can be integrated into the program as a whole.

3.6 Exploratory Grants and Centers

The strategy statements of the "Problem and Strategic Research Goals" are adequate. However, the rest of the issue Paper beats an ignominious retreat from the needs and responsibilities of the Agency.

The nature of the discrepancy between the needs and goals, on the one hand, and the status and directions, on the other, are obvious. The Committee asks that the strategy authors and research managers consider the following:

1) The program's original scope of 15% of ORD research has long since been abandoned.

2) The number of university-based Centers of Excellence has been reduced from 8 to 4 in the past and current years.

3) The current Administrator's goal of raising the exploratory grants program to $50 M in annual $10 M increments has been put in abeyance.

4) The stated intention to shift funds from a general solicitation for investigator-initiated grants to grants on Requests for Applications

(RFAs) written to meet programmatic research needs will reduce the viability of the modest program that currently exists. This breaks faith with the academic community that wishes to help EPA through a steady sequence of innovative and anticipatory research, and is therefore incompatible with the need for training of the next generation of researchers in university laboratories.

Program-oriented RFAs can and should be undertaken, and can utilize the peer review capabilities of the review panels. However, there is likely to be a net decrease in the long-term technical contribution to environmental decision making if support for the RFAs are drawn from the meager pool of funds available for general solicitation.

5) The stated intention to terminate the general solicitation in health research is poorly considered. It appears to be based on a misconception of recommendations in Reducing Risk. The SAB recommendation in that report was to achieve a balance between research in ecology, health, and control—not to abandon health. The Committee asks who will support extramural health effects and human exposure research focused on EPA needs if not EPA itself. There are many such needs that the National Institute of Environmental Health Sciences (NIEHS) programs simply do not address.

6) The abandonment of an investigator-initiated grant mechanism in favor of an RFA process is not consistent with the commitment to anticipatory research described in Section 3.5 of this report. In many instances, the RFA process could draw on such a limited portion of the health effects research community as to almost guarantee projects of poorer scientific quality.

Consequently, we note that a combination of both approaches to conducting research is essential for a strong research program.

It is not possible to determine the relationship between short and long-term efforts in this area absent a long term program description. Integration within EPA may also be a problem which should be addressed as illustrated in the effort to turn limited extramural grants program funds over to support internal program needs. The integration of Centers with other EPA programs was also not addressed.

4.0 ECOLOGICALLY RELATED STRATEGIC ISSUES

The members of Workgroup B believe that the strategy statements are generally very good, concise synopses of broad and complicated topics, and reiterate that the Agency planners are to be commended for these efforts. The strategies are generally informative and clarifying.

One overarching recommendation is that the strategies should provide more explanation of how each strategy is integrated with other programs within and outside the EPA. It is especially important that the interrelationships among the Terrestrial, Habitat/Biodiversity, EMAP, and Wetlands strategies be clarified and that their complementary attributes be described.

4.1 Terrestrial Systems

It is important to include this issue among the 39 top research strategy issues of ORD. The health of terrestrial ecosystems is important to both resource use and publicly perceived values. Therefore, an integrated approach to its management is crucial. Although resource management (especially of terrestrial ecosystems) has not historically been a part of EPA's mission, the Terrestrial Systems Issue is very much a matter of renewable natural resource management. The physical and chemical quality of the environment affects ecosystem production of resources, thus providing the rationale for the Agency's entrance into the resource management field. This rationale should be made explicit in the strategy.

A western watershed is an appropriate choice for one of the initial pilot studies because good capabilities exist for remote sensing and a base of ecological information in that region. The Committee also feels that some terrestrial landscape representation information in working forests of the upper Midwest is important as one of the candidate geographical areas.

One of the stated strategic research goals for the Terrestrial Systems issue is to answer the question, "What are the services valued by the public that terrestrial ecological systems provide?" The Committee feels that this approach is somewhat contrary to recommendations put forth in the Reducing Risk report in which the SAB notes the divergence that can occur between scientific evaluation and public perception of a given issue. Therefore, there should be more discussion in the issue strategy of how these "values" will be determined and used. How does the value of ecological resources and services to future generations fit into the strategy? The Agency should explicitly acknowledge that certain sets of values will cause basic conflicts in resource management and that

resource use and terrestrial system impacts are interrelated.

It is critical to articulate the EPA role in the process of resource management. Will one of the Agency's functions be to provide ecological information and management technology to resource managers in other agencies? It should be made clear that all land managing agencies will be included in this process and interagency cooperation will be important.

4.2 Habitat/Biodiversity

This is a critical topic to include in the Agency's list of issues and the Subgroup generally favors the research approach outlined in the document. It would be helpful in the problem definition section to describe why biodiversity is important and how habitat is important to maintaining biodiversity. In fact, a working definition of biodiversity and habitat would be appropriate at the outset. During the public meeting with the SAB, the Agency made several clarifications that could be included as part of the written strategy statement. These clarifications included a discussion of the uses of "greenness measures" from remote sensing imagery as a surrogate measure of habitats and invertebrate organisms as the indicator taxa for biodiversity. In this instance, however, the term "greenness" is confusing. The section does not adequately explain "how green is green" nor the relationship of "greenness" to diversity.

There are several issues that should be more fully considered in the strategic planning process. For example, direct human impacts on biodiversity (e.g., suburban sprawl, highways, uncontrolled land use patterns, etc.) affect plant and animal populations even though quality and quantity of habitat are unaltered. The strategy statement should explain whether its focus will be individual species or species assemblages; e.g., guilds. The Committee recommends the latter. In addition, the many cases of habitat boundaries where the integrating of species assemblages yields relatively higher biodiversity are an additional challenge. While the written strategy mentions "habitat of greatest value" regarding comparative risk assessment, there is no discussion of how such values will be determined.

At the February 28 meeting, the Agency indicated that the topic of geographic scale would be a primary research question and would be examined early in the research program. This aspect should be addressed explicitly in the document.

The "mitigation" aspect of this research strategy should be more fully developed. Specifically, as more habitat and biodiversity losses are identified as existing problems, it becomes more important to consider strategically (in the research planning context) just how mitigation of these problems areas will be accomplished. Therefore, RSAC recommends that the Agency consider

moving forward with these mitigation aspects prior to, or concurrent with, the more systematic assessment component of the research strategy.

The statement should clearly identify whether the focus of the research is

on all components of the biota or more specifically on the rare forms. More importantly, policy research into what can be done by EPA now in light of present scientific knowledge should be undertaken.

Finally, the Committee notes that answers to a fifth policy question are required in order establish research priorities within this issue strategy; i.e., "Which species and habitat types can we effectively manage for now and which need additional basic or applied research to effect appropriate management?" The balance between basic research and applied research must be maintained. Applied research provides technology that can address some immediate needs of the Agency for mitigation of existing problems and also identifies existing data deficiencies that must to be addressed by basic research. The required balance must ensure that concentrating on those habitats and species that are currently most at risk does not totally divert our attention from those components of the biota that are not perceived to be at immediate risk. Basic research directed at such resources should help the country manage and maintain them without costly restoration or mitigation activities. Key information about habitat requirements for assemblages of organisms will form a basis for efficient and economical management for biodiversity.

4.3 Wetlands

The Wetlands issue is clearly significant, and progress toward achieving the research goals will provide important practical information. The Agency is in a unique position to assume the lead in using the landscape approach in wetland function, health, and management. Consequently, the landscape level of investigation should be emphasized in the strategy statement.

The linkages between the wetlands issue and EMAP, Habitat/ Biodiversity, and even Terrestrial Systems should be addressed in the strategy. It is important that the integration and transfer of information between the research programs occur throughout the work, but especially in the early stages of the investigations.

Reference to some important wetland research is also missing from the strategy. For example, significant work on the cleansing function of wetlands has been contributed by the Kadlec brothers at the University of Michigan; John Kadlec in Canada, Utah, and Idaho, and by Howard Odum and his students in Florida, the Corps of Engineers and many other university based ecologists. In addition, an important body of

information on wetland construction exists as a result of 60 years of wetland construction by the U.S. Fish and Wildlife Service.

The Committee supports research emphasis on seasonally or periodically wet systems. This commendable proactive approach and should include overlooked systems such as playa basins, deserts, vernal ponds, and irrigated agricultural wetlands.

The Committee is concerned that the use of the phrase "categorizing wetlands" in the document could to be misunderstood as a reference to wetland delineation. It should be made abundantly clear that wetland categorization relates to functions and values (such as an important resource for drinking water), and not to the determination of wetland boundaries.

4.4 Environmental Monitoring and Assessment Program (EMAP)

The Committee agrees that EMAP is important for a holistic view of the environment and for the basic change of Agency strategies for environmental protection through long-term monitoring. The strategic direction is sound, except that additional emphasis should be directed toward providing interim results early in the effort. This near-term payoff will help ensure the long-term support necessary for EMAP's success. Because of its size, EMAP is a potential "lightning rod" for criticism from inside and outside the Agency. A series of EMAP symposia held at scientific meetings (e.g., ESA, SETAC, AAAS) displaying short-term results may be important to address potential criticism in a proactive way.

EMAP is a monitoring program that provides other programs with data including feedback on ecological condition. In the issue strategy, however, the distinction between monitoring and research is not made clear. In addition, some consideration of EMAP as an integral program within the agency would be helpful in the issue strategy. What is its current and anticipated relationship to programs and offices with the Agency?

4.5 Global Warming

The Committee recommends that the EPA clarify the strategy statement as to how it integrates with the international and national global warming research efforts. There are overlaps between the Agency's agenda and the agendas of other federal agencies (e.g., NASA's global atmospheric program), and these should be outlined. It is not clear whether EPA's research topics were selected because of high priority relative to the existing programs or because they matched EPA expertise. Therefore, it is especially important to address how the global warming strategy relates to other research within the Agency.

There are programs within the EPA, particularly in the area of effects on natural systems (e.g., terrestrial systems, habitat/biodiversity, wetlands, and EMAP), that could contribute to the global warming strategy if properly integrated. A discussion of such integration would improve the strategy statement.

The research topics addressed by the Agency require long-term commitments because they are complex problems. Although comprehensive answers to research questions cannot be expected for a number of years, it is reasonable to expect interim "deliverables." A more fully developed strategy document should identify the short-term objectives of the program and the interim milestones.

Five major scientific topics are identified in the strategy document, and a number of associated questions are presented. In order to adequately evaluate the strategy, a brief description of how the Agency will address these questions is needed. For example, under the topic "Atmospheric Chemistry," the Agency indicates that one of the program's tasks will be to calculate Global Warming Potentials (GWPs). Since GWPs have already been calculated, it is not clear why this is an important task within the research strategy. If the Agency expects to improve the existing estimates for GWPs, it should state this in the document and provide the associated rationale.

There are two key components missing from the atmospheric chemistry program: aerosols and CFCs (and other halogenated compounds). The radiative effects of aerosols are thought to be comparable to, but opposite from, the present effects of CO_2. It would be a serious oversight to exclude them from the research strategy. The direct radiative forcing due to CFCs and related compounds is similar in magnitude to methane, but more importantly, their atmospheric lifetimes can be an order of magnitude greater. Even if CFC emissions are completely eliminated today, the compounds already released will reside in the atmosphere for centuries. An additional complication is that although CFC substitutes like HFC-134a have an ozone depletion potential of zero, some have appreciable global warming potentials.

Finally, it is not always clear in the text of the issue strategy whether carbon dioxide or gases other than CO_2 are the intended focus for the research effort.

4.6 Environmental Releases of Biotechnology Products

The Committee questions the importance of this issue relative to the other 38 issues presented to the SAB. If this research is aimed at a proactive positioning of the Agency to address unperceived or unlikely environmental effects of products of biotechnology, this should be made clearer in the issue strategy.

The strategy calls for development of bioassay techniques that measure the diversity of community structure and function and identify the sensitive trophic interactions that are measures of ecosystem health. The strategy statement should be clarified to distinguish this activity from terrestrial habitat and EMAP activities.

4.7 Bioremediation

The Bioremediation Issue Strategy covers the topic well and addresses the major points made by the SAB Environmental Engineering Committee in a recent review of the subject. Successful remediation of chemical releases will require effective and timely technology transfer to the private sector, and this component of the issue strategy may require additional emphasis.

The problem of materials handling also merits a special research emphasis. For example, how can a contaminated substrate be brought into contact with the bioremediation product, while simultaneously maintaining proper physical/chemical conditions that will promote bioremediation. The issue of mass transport relates more to providing contact between added microorganisms, nutrients, co-metabolites, and the contaminant.

The "Process Research" component of the issue strategy indicates a focus limited to identification of microorganisms that degrade contaminants. This emphasis seems inconsistent with the broader goals of process research in general.

APPENDIX

Detailed comments of Dr. Richard Bull on:

DRINKING WATER POLLUTANTS AND DISINFECTANTS

1. The Congressionally mandated evaluation of 25 pollutants every three years is not an issue that can be rationally planned as a research program. Consequently, it should be separated from the drinking water disinfectant issue.

2. The responsibility for producing safe drinking water lies largely in the public sector. Recently, the Agency has mandated the use of disinfectants through the Surface Water Treatment Rule. Consequently, the responsibility for resolving problems with disinfection falls clearly with the Agency.

3. The Agency has no basis for determining the impact of an MCL for any disinfectant by-products on the health risks associated with drinking water. A single restrictive MCL can necessitate large investments of public funds into alternate methods of water treatment that may generate a completely different set of by-products or potentially compromise protection against waterborne infectious disease. The data base does not exist for the rational evaluation of the alternatives to chlorine.

4. The drinking water disinfectant and disinfectant by-product issue is a very complex problem requiring a much higher level of resources than indicated in the strategy if it is to be resolved by the end of this century.

5. The FY93 resources indicated in these documents for health effects research are much greater (i.e. 2-3 times) than the Drinking Water Committee was led to believe in its recent review of the Health Research Laboratory's program in December of 1991.

6. It is extremely important that the disinfectant problem be considered one of competing risks. All disinfectants lead to the formation of by-products, but the problems are more complex than implied in the strategy. The toxic and/or carcinogenic by-products are not only chlorinated organics. They include inorganic ions of considerable concern such as chlorate, chlorite and bromate. Additionally, brominated organics are produced by either chlorination or ozonation in waters containing trace amounts of bromide ion. Based on the limited data that is available, the cancer risk associated with chlorination, chloramination or ozonation differs marginally, all approaching a 10^{-3} additional lifetime risk as calculated by the linearized multistage model. In waters containing bromide (a fairly common occurrence), bromate formation from ozonation could present a more serious hazard, but field data are quite sparse. Some evidence suggests that the formation of brominated organics could be exacerbated by the removal of organic carbon. This is because bromination occurs preferentially to chlorination. There is little knowledge of the toxic properties of by-products of disinfectants other than chlorine. Additionally, it is

important that alterations in drinking water disinfection practice do not significantly increase the risks from waterborne infectious disease.

7. The impact of alternate forms of disinfection on other ORD initiatives (e.g. indoor air, risk assessment methods) has apparently been considered only on the most superficial level.

8. The trend lines in the budget reflect a naive understanding of the need for a highly interactive research program in this area. Efforts to identify critical by-products, to determine the efficacy of alternative disinfectant treatments, to collect the data that are needed to estimate the impacts on public health and to develop the appropriate risk assessment methodologies for measuring comparative risks make sense only with in a highly coordinated, iterative process. The budget lines provided imply a sequential process that does not logically lead to a solution of the problem.

It has been traditional in this area that as information is developed about by-products that will limit the use of a treatment option, new treatments or combinations of treatments will be explored by the drinking water industry that will create new problems for research.

9. It is extremely important that the Agency develop an epidemiological capability to address problems in drinking water. This is particularly important for confirming that risks from waterborne infectious disease are not increased by alterations in water treatment practice.

Epidemiological investigations of chemical hazards should also be conducted, but in a much more deliberate manner. These studies should be focused on differentiating between the effects caused by use of different disinfectants and the modification of risks that may be contributed by other water quality characteristics (e.g. TOC, pH, other water treatments). Efforts should not be directed at individual by-products since it will not be clear what the major by-products are for non-chlorine alternatives for some time in the distant future.

10. The strategy does not provide a clear concept of how this issue is to be managed. The limited resource base indicates a need for a strong mechanism of prioritization that insures that the limited resources remain focused on the problem and do not get bogged down in expensive fishing expeditions. Toxicological studies should be directed towards identifying and characterizing the toxicological properties of major byproducts. Prior data suggests that carcinogenic and reproductive/teratologic effects are the most critical effects. One by-product (dichloroacetate) appears to be a neurotoxin, but heptatoxicity and cancer appear to occur at lower doses. Microbiological risks must also be studied in focused way. Research should focus on those organisms that are most likely to increase in incidence as effectiveness of disinfection decreases. Thus work would not be directed at those organisms not susceptible to disinfection at all (e.g. Cryptosporidium), but on those that are marginally controlled by

disinfection (e.g. Giardia)

11. ORD does not seem to recognize the very substantial trade-offs there are between human health and ecological concerns this issue raises. It is very important that the coordinator of this program keep in contact with the regulated community, which is also primarily in the public sector.

GROUND WATER ISSUE STRATEGY

1. It is very difficult to defend this issue on a risk basis except perhaps as a microbiological problem. Ground water pollution contributes a very small component to nationally weighted health risks in drinking water compared to chemicals introduced in treatment and distribution of the water. This has to be true in the context of indoor air pollution as well.