



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

DEC 22 1992

204.92.022

Dr. Raymond Loehr, Chairman
Science Advisory Board
401 M Street, SW
Washington, D.C. 20460

THE ADMINISTRATOR

Dear Ray:

Thank you for your letter of July 28, 1992, transmitting the Research Strategies Advisory Committee's report, *An SAB Report: Review of 14 Strategic ORD Research Issues for FY 1994*. The report is thorough in its review of the fourteen research issue strategies, and your letter provides valuable comments on the new ORD planning process as a whole.

I am quite gratified to learn that the Committee supports ORD's efforts to improve the quality and integration of the research program by moving to issue-based planning. I anticipate that the new structure of the research program will link research more closely with the environmental policy and decision-making in the Agency.

The Committee noted the considerable influence of *Reducing Risk* and *Future Risk* in the research issue strategies, but raised the concern that the significance of relative risk, as it relates to the research effort, is not adequately explained. The research issues address the concept of relative risk in two ways. First, research issues have been formulated to focus on high risk environmental problems. Notably, specific research issues address the high risk problems identified in *Reducing Risk*, including global change, stratospheric ozone depletion, habitat/biodiversity, criteria air pollutants, drinking water pollutants, human exposure, and indoor air pollution. Within the research issues, risk reduction research efforts will focus on the most significant opportunities for risk reduction, with special emphasis on pollution prevention and other truly innovative technologies. Secondly, we have created several research issues that focus on improving our ability to accurately assess and compare risks. Such research will be conducted in the health risk assessment methods and ecological risk assessment methods issues, and will be coordinated with other relevant health and ecological research.

The Committee was also concerned about the research budget. As you know, the research program has been a high priority during my tenure, and has received



substantial budget increases over the past few years. Importantly, we followed the SAB's recommendations in using the increases to improve our research program in the areas such as environmental monitoring and assessment, ecological risk assessment, human exposure, and pollution prevention.

Finally, the Committee recommended that ORD not abandon "discipline-based tracking of activities and resources." ORD is strongly committed to planning the research program in an issue-based framework. However, implementation of the research plans will remain the responsibility of the discipline-oriented offices and laboratories. Thus, activities and resources will be tracked and reported by office (i.e., discipline) as well as by research issue.

I am very pleased with the interaction to date between ORD and the SAB on the new research planning process. I understand that the research plans for each issue will be ready for SAB review in the near future. I hope that the expertise of all the Committees will be used in reviewing the research plans. I anticipate that as we move forward in developing and implementing the research program, the SAB will remain closely involved.

Sincerely yours,



William K. Reilly

Enclosure

Thanks again, Ray. This is a genuine success, and I believe, a lasting one.

ORD'S RESPONSE TO THE SCIENCE ADVISORY BOARD'S
RESEARCH STRATEGIES ADVISORY COMMITTEE

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

This document presents the response of ORD to the July 1992 report, "An SAB Report: Review of 14 Strategic ORD Research Issues for FY 1994." The Committee's report includes a few general comments and detailed comments on each of the fourteen issues.

General Comments

1. Adequacy of Strategic Direction

Committee comments: It would be appropriate to develop an introductory synopsis of the overall strategic plan for ORD efforts. In many cases, the issue strategies do not provide a consistent and adequate basis for research direction. More meaningful characterization of the level of effort and distribution by discipline for each research topic is recommended.

Response: An introduction, which discusses overall ORD strategic directions and the new issue-based planning process, will be included in the publication of the issue strategies document. Many of the issues have been revised to more clearly convey the rationale and approach for research (see specific responses, below). Because the issue strategies are meant to provide broad overviews of the research program, ORD decided to include more specific information on levels of effort in the research plans, rather than in the issue strategies.

2. Balance Between Short- and Long-Term Efforts

Committee comments: In most instances, little information was provided relating short- and long-term efforts.

Response: As the Committee noted, graphics were included in the issue strategies which portrayed the expected changes in emphasis within the research program over the next five years. For the issue strategies, the primary purpose was to convey the major directions for each research issue. More detail on short- and long-term efforts will be included in the research plans.

3. Integration of Research Efforts

Committee comments: The extent and mechanism of integration between EPA and other organizations, or within EPA itself, could not easily be determined from the descriptions provided.

Response: ORD recognizes the importance of coordination of research, both with other research issues and with other research organizations. In many cases, such coordination is mentioned briefly in the issue strategies. In the more detailed research plans, coordination with other programs and organizations will be a separate section, to ensure that this topic is adequately addressed.

Nonpoint Sources

Committee comments: The strategy provides a good overview and adequately reflects EPA's role in the larger national effort to address a critical environmental issue ... current efforts focus on selected problem areas ... a truly national effort will require considerably more resources.

Response: ORD appreciates the Committee's comments, and acknowledges that with the limited resources currently available, only selected problems can be addressed.

Indoor Air

Committee comments: Indoor air: While the focus is on pollutant exposures that cause neurotoxicity, irritation and other non-cancer health effects, carcinogenic effects should not be ignored. Bioaerosols and organic vapors warrant more research. Radon: the focus on mitigation research is appropriate. EMF: question whether it should be included as an indoor air issue, but agree that possible interactions of other agents and EMF indoors cannot be ignored.

Response: ORD agrees with the SAB comments, and will reflect these comments in the research plan.

Health Risk Assessment Methods

Committee comments: Improved risk assessment methods could facilitate the identification of critical research needs. The strategy is directed at individual chemical risks and comparisons between risks that are manifested through similar mechanisms. Efforts are also needed to compare risks of different types, e.g., human health risks caused by ecological effects risks vs. other direct human health risks.

Response: ORD agrees with these comments and will revise the issue strategy and research plan to address these issues.

Environmental Education and Outreach

Committee comments: The panel expressed difficulty in reviewing environmental education and outreach since it did not address research needs, and noted that the panel members had little background or experience in the principal area of focus of the ORD program (K-12 grade). Suggestions for program include: (1) coordination with the Office of Environmental Education on educational research; (2) addressing critical needs for graduate and post-graduate training in engineering and science; and (3) greater integration with the programs of NSF and NIEHS.

Response:

ORD's environmental education program consists of several existing outreach and community service programs initiated by the laboratories, coupled with a series of budget initiatives which were approved through the FCCSET Committee on Education and Human Resources. In addition, ORD has a modest academic training program which is operated through the Office of Exploratory Research. ORD coordinates closely with the Office of Environmental Education (OEE) on all matters affecting education.

The available data from degree granting institutions do not suggest a critical shortfall in graduate and post-graduate scientists and engineers. ORD is concerned that a more culturally diverse workforce (women, minorities and handicapped) is not available, and ORD has instituted a modest program to recruit, train and retain such individuals in our workforce. ORD has been working with NSF over the past several months to better coordinate our efforts. We are not aware of any program with NIEHS, but are actively involved in cooperative programs with the Department of Energy.

Anticipatory Research

Committee comments: The strategic goals and directions of this new program appear to be generally appropriate. Several aspects remain unclear: What level in the organization will it operate? Will it be used to seek out really new problems?

Response: ORD agrees that these issues need to be resolved for the anticipatory research program to be effective. Obtaining funds to complete planning and begin implementation of this new research program remains a high priority for ORD.

Exploratory Grants and Centers

Committee comments: The strategic goals statements for this topic are adequate, but the status and direction of this program fail to meet the needs and responsibilities of the Agency. Specifically:

- The programs's original scope of 15% of ORD research has long since been abandoned.
- The number of Centers of Excellence has been reduced from 8 to 4.
- The current Administrator's goal of increasing the program to \$50 million in \$10 million increments has not been met.
- The intention to shift funds from a general solicitation to RFAs will reduce the viability of the modest program that exists.
- The intention to terminate the general solicitation in health research is poorly considered.
- The abandonment of an investigator-initiated grant mechanism in favor of an RFA process is not consistent with the commitment to anticipatory research.
- Integration within EPA may also be a problem which should be addressed.

Response:

ORD appreciates the agreement of the Committee with the "Problem" and "Strategic Research Goals" sections of the Exploratory Grants and Centers Strategy. Clearly the SAB shares our objective of working effectively with the academic community. However, it is also clear that the constraints placed on us by budget limitations and our attempt to deal with them responsibly has led to different opinions about the way our programs should proceed in the future.

ORD continues to be committed to increasing our emphasis on working with the academic community in exploratory research. We will continue to request increases in these budgets. In Administrator Reilly's testimony before Congress last fall, he publicly expressed his intention to increase the budget for the grants program to \$50 million over time. Undoubtedly, the Committee realizes how difficult it is to do that in today's extremely difficult budgetary climate.

The Committee somewhat misinterpreted ORD's intentions with respect to shifting funds from the general solicitation to specific programmatic areas represented by Requests for Applications (RFA). We do indeed intend to focus our limited available resources in the environmental health area by identifying rather specific research areas for funding attention. We have already successfully experimented with that approach in several research programs in the past. We have decided that the Agency's goals will be better served by that approach so long as funds are so severely limited. However, in the other programmatic areas, we will

continue to issue general solicitations. In the future, when we hope the funding picture will improve, we will reintroduce our general solicitation in health. We are gratified that the Committee agrees that a strong research program would embody a balanced program of a combination of both general solicitations and specific RFAs, which is ORD's long-term objective.

The Committee is correct in noting that the National Institute of Environmental Health Sciences has a large extramural program. Obviously that fact was considered in the decision to focus environmental health grants through the RFA process. We are certainly aware, however, that EPA has research needs that will not be addressed by NIEHS. We hope to be able to reinitiate our health grants program in the near future.

The Committee is correct in noting that the Strategy document does not address the relationship of Centers with other EPA programs. The longer research plan does address the point to some degree, and the Office of Exploratory Research has been directed to give particular attention to this issue over the next year. ORD intends to foster a system of collaborative research within the grants and centers programs that supports both individuals and teams of investigators in the academic community, while at the same time it provides information in support of EPA internal program needs.

Terrestrial Systems

Committee comment: The SAB supports the need for integrated management of renewable natural resources. Further, the Committee asserts that while resource management has not historically been a part of EPA's mission, the EPA's regulatory responsibility over the physical and chemical quality of the environment affects ecosystem production of resources. The Committee recommends that the rationale for this issue focus on how the physical and chemical quality of the environment affects the production of renewable resources in terrestrial ecosystems.

Response: This is a sound recommendation; such a focus provides a defensible basis for research, and establishes complementary research to established programs dealing with aquatic systems.

Committee comment: The Committee recommends that a terrestrial landscape in the working forests of the upper Midwest be included.

Response: Accepted.

Committee comment: The Committee contends that research to answer the question, "What are the services valued by the public that terrestrial systems provide?" is contrary to the recommendations put forth in the *Reducing Risk*

report. This is because public perception is often at odds with scientific facts. The Committee recommends that the issue should be more explicit on how "values" will be determined and used.

Response: The definition of measurable "values" for terrestrial ecological systems is really the crux of this research problem. A significant and initial task will be to establish ecologically meaningful parameters that are also relevant to resource values.

Committee comment: The Committee asks if the Agency will provide ecological information and management technologies to resource managers in other agencies, and asserts that land management agencies must be included in a cooperative manner.

Response: Clearly, the land management agencies must be involved at least to provide ecological data and expertise on management practices. It is not clear what the EPA will provide in return. If, as the Committee suggests, the focus of the issue is physical and chemical environmental influences on terrestrial ecosystems, the primary use of research results would be within the Agency to support policy decisions. Certainly, the information would be of use to land management agencies in helping them define land use policies, and close cooperation will be needed.

Habitat/Biodiversity

Committee comment: It would be helpful in the problem definition section to describe why biodiversity is important and how habitat is important to maintaining biodiversity. Working definitions of biodiversity and habitat would be desirable.

Response: The strategy will be revised to reflect these points as follows. Biodiversity is the manifestation of genetic diversity. Genetic diversity through natural selection allows evolutionary accommodation to environmental change. Habitat is the ecological support structure for biodiversity. The operational definition of biodiversity must vary with spatial scale. At the national scale, species number is a first order estimate of biodiversity. At a regional scale, species frequency distributions are better descriptors of biodiversity. At the scale of a watershed or forest stand, direct measures of genetic diversity within populations may be more appropriate. Likewise, the operational definition of habitat must vary with spatial scale from metrics of remotely-sensed spectral bands at the national scale to direct measures of physical attributes at a local scale.

Committee comment: ...direct human impacts on biodiversity affect plant and animal populations even though quality and quantity of habitat are unaltered.

Response: Agreed. Habitat fragmentation is one of the primary stressors to be evaluated.

Committee comment: The Strategy statement should explain whether its focus will be individual species or species assemblages.

Response: Species assemblages.

Committee comment: There is no discussion of how "habitat of greatest value" will be determined .

Response: This is not entirely resolved. Candidate criteria for high value include: habitats that support species assemblages contributing the greatest amount to overall genetic diversity, habitats supporting species types with life histories that make them vulnerable to habitat fragmentation and loss, habitats that support major ecological guilds, and habitats that support rare species.

Committee comment: "the Agency indicated that the topic of geographic scale would be a primary research question and would be examined early in the research program."

Response: Research projects are specifically addressing the issue of scale in the first three years of the project.

Committee comment: The "mitigation" aspect of this research strategy should be more fully developed.

Response: This recommendation appears to be contrary to the primary thrust of the *Reducing Risk* report which recommends evaluating relative risk before allocating resources to mitigation. Also, habitat management research has been a focus for resource management agencies such as Fish and Wildlife Service and Forest Service. The unique contribution that EPA can make is to improve the state-of-the-science of comparative risk assessment. Nevertheless, three pilot studies will be undertaken during the first five years which focus on developing habitat improvement plans for watersheds in different landscape types.

Committee comment: The statement should clearly identify whether the focus on the research is on all components of the biota or more specifically on the rare forms.

Response: While in concept all biota are included, in practice the research will focus most heavily on vertebrates and higher plants, since these are the groups with the largest information bases and greatest political constituency.

Committee comment: ...policy research into what can be done by EPA now in the light of present scientific knowledge should be undertaken.

Response: This goes beyond the scope of the ORD Issue strategy and should be undertaken as an Agencywide effort, perhaps by the "Habitat Cluster."

Committee comment: Finally, the Committee notes that answers to a fifth policy question are required in order to 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?"

Response: This comment seems to suggest a species by species or habitat by habitat approach to management. This approach is what got us where we are today and is not going to cause dramatic improvement in the future. If the question were re-phrased to say "which species assemblages..." the answer would be that none can be currently managed effectively and all need additional basic or applied research to achieve appropriate management. The need for an appropriate balance between basic and applied research is well taken. We agree that, "Key information about habitat requirements for assemblages of organisms will form a basis for efficient and economical management for biodiversity." Developing that "key" information is the thrust of the ORD Issue Strategy.

Wetlands

Committee comment: Integration and transfer of information between Wetlands and other issues, especially EMAP and Habitat/Biodiversity should be addressed.

Response: There has been a history of integration and transfer of information between EMAP-Wetlands and Habitat/Biodiversity. The association with EMAP-Wetlands was briefly addressed in the Wetlands issue strategy, but we will show linkages with other issues more explicitly in the revised strategy.

Committee comment: Reference to important work was missing, e.g., Kadlec on constructed wetlands and other university-based ecologists, and other agencies like the Army Corps of Engineers and U.S Fish and Wildlife Service.

Response: The writers of the Wetlands issue are very much aware of the work referenced by the SAB. Unfortunately, the format of the issue strategy did not allow for the presentation of a thorough literature review. Such a review will be done as part of the implementation plans for each of the components of the issue and will be included in the revision of the issue strategy as appropriate.

Committee comment: Research emphasis on seasonally or periodically wet systems is supported. Overlooked systems such as playa basins, deserts, vernal ponds, and irrigated wetlands should be included.

Response: The current Wetlands issue does not directly address systems such as playa lakes and vernal ponds. The decision was made to concentrate the limited funds in the program to wetland types and regions where there was a need for information and for which that information has a high probability of being applied to similar systems in other parts of the country. For example, the choice of the emergent wetlands of the Prairie Pothole Region was influenced by the need for information on wetlands in the region and by the fact that emergent wetlands were a major wetland type nationally and findings in the Prairie Pothole Region would have broader applications. However, as funds become available we will consider studies on other overlooked systems. In FY93, we will conduct a state-of-the-science review of the functions of irrigated wetlands in a study requested and funded by EPA Region 8. The revised strategy will reflect these additions.

Committee comment: Concern that the use of the phrase "categorizing wetlands" could be confused with delineation.

Response: We appreciate the fact that categorization and delineation can easily be confused when used outside of the regulatory context. The revised plan will clearly define categorization and delineation the first time they are used and will remind the reader of the definition in parenthetical phrases when the terms are used later in the document.

Environmental Monitoring and Assessment Program (EMAP)

Committee comment: ... additional emphasis should be directed toward providing interim results early in the effort.... A series of EMAP symposia held at scientific meetings may be important to address potential criticism in a proactive way.

Response: EMAP's management recognizes the importance of emphasizing interim results in order to demonstrate the program's utility and gain necessary support for its long-term research objectives. To date, EMAP has communicated preliminary results from mid-Atlantic estuaries, New England forests, and northeastern lakes to EPA program offices, members of Congress, and key participants at the state level and within other federal agencies. EMAP is working to expand its communication strategy, including the presentation of EMAP symposia at scientific meetings. In FY92, EMAP sponsored full sessions at SETAC, the International Geographic Congress, and the ECOINFORMA conference in Germany.

Committee comment: The distinction between monitoring and research is not clear.

Response: EMAP has been advised by the NRC and other peer-review panels to strengthen its research component, and the program is taking major steps towards implementing this recommendation. In addition, future descriptions of the program, starting with the revision of the five-year issue research plan, will describe more clearly the distinction between EMAP's monitoring and its innovative ecological research component. This distinction will also be clarified through the new ORD reporting process.

Committee comment: What is EMAP's current and anticipated relationship to programs and offices in the Agency?

Response: Concerning intra-agency relationships, in addition to working closely with eight ORD laboratories and all of the EPA Regions, EMAP is currently coordinating with a number of EPA programs and offices with which EMAP shares objectives and methods. Intra-agency partners include the ORD Risk Assessment Forum, Habitat Initiative, and Global Climate Change Program; OW's Office of Wetlands, Oceans and Watersheds; the OPPTS Office of Pesticide Programs; and OPPE's Environmental Statistics and Information Division and the Office of Strategic Planning and Environmental Data. This last partnership has greatly facilitated the communication of EMAP objectives and progress to other EPA program offices as well. More explanation of the nature of these partnerships will be provided in the revised FY94 EMAP Issue Research Plan.

Global Climate

Committee comment: EPA should clarify the strategy statement as to how it integrates with the international and national global warming research efforts. It is especially important to address how the global warming strategy relates to other research in the Agency.

Response:

ORD agrees with the Committee on the need to articulate the relationship of the EPA research program to the national USGCRP and the international global change research efforts. Space constraints prevented this from being done in the issue strategy, and even from covering this in any depth in the issue research plan.

Concerted efforts have been made to integrate the EPA Global Climate Research program (GCRP) with the other research efforts of the Agency. For FY 1993 more than \$110 million of contributory research within the Agency has been

identified that relates to or helps provide a scientific base for the focused research of the GCRP. Especially close links with the Stratospheric Ozone and EMAP issues are being forged. We recognize that it is not possible scientifically to separate the physical and biological processes associated with human-induced stratospheric ozone depletion and human-induced climate change. Thus, we see the need to very closely harmonize the planning and management of these two programs. Similarly, human-caused land cover changes are one of the drivers of regional and global climate change. Consequently, we are coordinating this aspect of the GCRP effort with the EMAP.

Even more concerted efforts have been expended to integrate the GCRP with the USGCRP. These efforts and their results are documented in two series of documents, the most recent editions of which are "Our Changing Planet: The FY 1990 Research Plan," and "Our Changing Planet: The FY 1993 U.S. Global Change Research Program" (both published by the Committee on Earth and Environmental Sciences). Reference should be made to these documents, as there is far more detail than what can be described in a brief issue strategy description.

Briefly, our linkages in the process research area are particularly closely planned with NSF, USDA, NASA and DOE; in the earth system modeling area with NOAA, NSF, NASA and DOE; and in the monitoring area with NASA, NOAA, USDA and DOE. Assessment activities are still in a planning state within the USGCRP, but initial work in this area is being done with full interagency coordination. This close interagency interaction has been very beneficial in helping us to position the GCRP in high priority science areas where EPA has strong science expertise. Our GCRP mitigation work is excluded by OMB directive from being in the focused USGCRP, but this work is closely tied to the global change emission characterization work, and to this extent benefits from its institutional linkages.

The GCRP has also exerted considerable effort to build linkages with the international global change research and assessment community, both within the structure of the USGCRP and on our own initiative. These linkages are primarily focused on activities within the Intergovernmental Panel on Climate Change and the International Geosphere/Biosphere Program (IGBP). An especially strong linkage exists with the Global Analysis, Interpretation, and Modeling (GAIM) activity of the IGBP where we fund the GAIM program office and enjoy a close working relationship with its chairperson. GAIM was recently changed from an IGBP core project to a cross-cutting activity interacting with all core projects, so this gives us entry to all relevant IGBP core projects.

Committee comment: The research topics addressed by the Agency require long-term commitments because they are complex problems ... A more fully developed strategy document should identify the short-term objectives of the program and the interim milestones.

Response: With regard to short-term objectives and interim milestones, the GCRP has developed an extensive list of research products, or "deliverables." Likewise, the USGCRP has adopted its interim set of "milestones" for four successive time periods: 1991-1995, 1996-2000, 2001-2010, and 2011-2020. We have developed a listing of the relevant USGCRP milestones and the GCRP deliverables which contribute to these milestones.

Committee comment: Five major scientific topics are identified in the strategy document, and a number of associated questions are presented. A brief description of how the Agency will address these questions is needed. For example, the Agency indicates that one of the program's tasks will be to calculate Global Warming Potentials (GWPs) ... GWPs have already been calculated. If the Agency expects to improve the existing estimates for GWPs, this intent and the associated rationale should be stated.

Response:

There has been a restructuring of how ORD's Global Climate Research Program (GCRP) is described between the writing of the Issue Strategy and the Issue Research Plan. This was done in order to develop a one-to-one correspondence between its components and those of the newly restructured USGCRP. Its five activity-related components are now: monitoring, process research, earth system modeling, assessments, and mitigation research. The draft issue research plan addresses, for the relevant science questions under each component, how the GCRP will develop scientifically-credible answers to these questions.

Specifically, on the Global Warming Potential (GWP) example cited, we recognize that GWPs have been used for several years, particularly in policy discussions. But we also recognize there exists substantial scientific uncertainty over the appropriate numerical values to use. This uncertainty arises from several factors, some of which are not readily resolved. These include: a) each greenhouse gas produces its own unique latitudinal and altitudinal changes in radiation transfer and consequent warming, so CO₂ equivalency becomes problematic on anything but a global scale; b) the indirect component of GWP for each greenhouse gas is poorly understood; c) it may be inappropriate to apply the concept of GWP to a short-lifetime gas, such as tropospheric ozone or its precursors; and d) the atmospheric lifetime dependency of GWPs requires a better understanding of the lifetime for most gases. See "Climate Change 1992: The Supplementary Report to the IPCC Scientific Assessment," Section A2.3 for a fuller discussion of these problems. These problems with GWPs will likely be a major topic in the IPCC W/G 1 1994/95 assessment now under development.

Committee comment: There are two key components missing from the atmospheric chemistry program: aerosols and CFCs (and other halogenated compounds).

Response:

Our current understanding is that direct effect of tropospheric aerosols is to either cool (sulfate) or warm (carbonaceous), depending on their composition, which determines their radiative scattering and absorption properties. Additionally, sulfate aerosols play an important role in the formation of cloud condensation nuclei, but the micro physics and chemistry that links their ambient concentration with the subsequent formation of cloud droplets, and their collective radiative properties, is poorly understood. The formation, dynamics and radiative effects of tropospheric aerosols are scheduled in the draft issue research plan to become active research topics in the GCRP beginning in FY95.

We understand the climate changing properties of CFCs and their substitutes to be complex. The direct radiative effects of these compounds are very strong, but these are presently offset to a major degree at the global scale by the depletion of ozone in the lower stratosphere which the CFCs induce. This offsetting of direct with indirect effects is strongly latitudinally dependent, and would be expected to change in the future as substitutes replace the CFCs. The stratospheric ozone issue contains work on the tropospheric transport and fate of CFC substitutes. Work on other aspects of this problem is contained in the research plans of other agencies within the USGCRP.

Committee comment: It is not always clear whether carbon dioxide or gases other than CO₂ are the intended focus of the research efforts.

Response: Both the USGCRP and the GCRP include all radiatively-active and related chemically-important trace gas species that force global climate change. The GCRP's current focus is on the biospheric part of this problem, and how it is linked through biogeochemical cycling with atmospheric concentrations of trace gases. Necessarily, this places a strong emphasis on the global carbon cycle, and studying the coupling between the biological/ecological system elements and the physical system elements of the fully coupled Earth system. As the program matures, it is expected that a larger portion of the effort will be directed towards integrative assessment activities.

Environmental Releases of Biotechnology Products

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

Response: The Committee is correct in stating that the Agency is taking a proactive stance in addressing the environmental release of biotechnology products. As the strategy document states, "Such products fall within the regulatory framework of the Toxic Substances Control Act or as pesticides under the Federal Insecticide, Fungicide, and Rodenticide Act. It is the Agency's responsibility to assess the potential risk to human health and the environment from the use of such products." Because of the growth of the biotechnology industry, the tremendous potential for the development of valuable products, and continuing public concern about the consequences of releasing genetically engineered organisms, we feel it prudent to be conducting research in this area.

Committee comment: 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 should be clarified to distinguish this activity from terrestrial habitat and EMAP activities.

Response: In terms of the research on bioassay techniques mentioned in the Biotechnology Strategy, the research addresses the development of such methodology in the context of biotechnology products. There will continue to be the need for development of other bioassay methodologies in connection with other research issues.

Bioremediation

Committee comment: The Bioremediation Issue Strategy covers the topic well and addresses the major points made by the SAB Environmental Engineering Committee in a recent review. Transfer of technology to the private sector may require additional emphasis. The problem of materials handling also merits special research emphasis. In the "Process Research" component, the focus on identification of microorganisms that degrade contaminants seems inconsistent with the broader goals of process research in general.

Response: ORD appreciates the Committee's comments on the bioremediation strategy. The problem of materials handling and other specific comments will be addressed by the issue planning group in the writing of the research plan.

APPENDIX

This Appendix responds to the detailed comments of Dr. Richard Bull on the Drinking Water Pollutants and Disinfection research issue strategy, included in the Appendix to the SAB Report. Because of the length of the comments, the comments are not repeated here. The answers below are numbered to correspond to the comments.

Drinking Water Pollutants and Disinfection

The SAB input has been very useful to the ORD Issue Planners for Issue #19- Drinking Water Pollutants/Disinfection.

1. It is prudent to consider the research schemes in light of the statutory mandates in the Safe Drinking Water Act amendments and the need to consider improvements in Congressional strategies to increase cost effective research and to provide for feedback to the Office of Water (OW) and Congress on better ways to achieve environmental protection. The issues of pollutants and disinfection are linked scientifically, legally, and programmatically thus, the current ORD plan is appropriately constructed.
2. ORD has the mandate to conduct research to support the OW regulatory process. We concur that a federal approach is needed to address problems arising from disinfection processes.
3. We agree that EPA does not have a sound technical foundation to evaluate the risks posed by alternative methods of disinfection. We support OW's regulatory negotiation approach which should lead to reasoned decisions for the near future. For the longer term, the ORD research plan addresses the gaps in knowledge, emphasizing the investigation of ozonation plus residual management.
4. The drinking water issue strategy was developed, as were all the issue strategies, under the assumption that the budget would remain constant for the foreseeable future. Given the fiscal conditions of the current time, this is a prudent assumption. Additionally, under such conditions, it is important to make every effort to ensure that the available funds are targeted to the highest priority research topics within each area, and we felt this could best be accomplished by careful examination and allocation of the current base resources. This approach to development of the issue strategy does not preclude funding increases in future years, and drinking water research remains a high priority for ORD because of the extreme complexity of the problem and the need for more information for rationale decision-making.

5. This apparent inconsistency in resource levels has probably resulted from the shift to Issue Planning and budget clustering in ORD; previously, it is likely that resources were shown for individual units such as HERL. These figures are likely to change again as ORD budgeting is fine-tuned throughout FY 93, our transition year to the issue planning process.

6. ORD agrees with Dr. Bull's point that a comparative risk approach is needed to evaluate the tradeoffs between reducing disinfection by-products and potentially increasing risks from waterborne infectious disease. As the comment indicates, the disinfection problem is extremely complex. Little is known about the risk from ozonation, thus any comparisons amongst treatment options are premature at this point. A further complication which is discussed in the research plan is the limited health and risk data on microbials.

7. Integration and coordination of issue plans is of great importance to ORD and will improve over time. Drinking water research efforts will be coordinated with work in Risk Assessment Methods, Indoor Air, Ground Water, and other issues as appropriate.

8. The graphs which show changes in research emphasis over time were developed under the required assumption of a stable future budget. As indicated above, drinking water research is a high priority for increased effort, as funding becomes available.

9. We fully concur that capability in epidemiology needs to be developed. ORD is vigorously pursuing this area of research, as indicated in the drinking water research plan.

10. We agree that the limited resources currently available need to be carefully targeted to the problem. The specific suggestions for focusing the research are constructive and will be considered by the issue planning group as we move to the next phase of specific implementation plans.

11. The Issue Planner will be both visible and accessible with/to the regulated and public communities to receive as much advice and counsel as is available. This includes participation with OW on the disinfection rule regulatory negotiation process.