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Report of the Pollution Prevention Subcommittee

Review of the ORD Draft Pollution Prevention Research Plan: Report to Congress

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

EPA-SAB-EEC-89-037

September 29, 1989

OFFICE OF
THE ADMINISTRATOR

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

Dear Mr. Reilly:

The Science Advisory Board has completed its review of the Office of Research and Development's (ORD) Draft Pollution Prevention Research Plan: Report to Congress (dated February 15, 1989), and is pleased to submit its final report. This report resulted from a review meeting on March 9-10, at which time Subcommittee members discussed the Draft Report with representatives of ORD and from subsequent evaluations. The major conclusions and recommendations of the Subcommittee's report are as follows:

1. The Pollution Prevention Research Plan Report to Congress provides an excellent framework for addressing the critical research elements to support a more comprehensive Agency-wide multi-media pollution prevention initiative.

2. A major EPA research, education, and technology transfer program will be needed to change from the current command and control end-of-pipe approach, to a pollution prevention mentality. As examples, stratospheric ozone depletion, urban ozone, global climate change, groundwater protection, wetlands protection, municipal solid waste, and oil and hazardous substance spills are some of the many areas which can not be controlled by typical "end-of- pipe" strategies.

3. The SAB feels the report would be made more meaningful by including more detail on: a) management, organization, and resource allocation demonstrating commitment from the top; b) preventing pollution from nonindustrial sources; c) relationships with the efforts of other federal agencies, and d) ways to measure progress.

4. We recommend that priorities be changed to emphasize early those studies having the largest potential for developing bold, new initiatives having major (vs. incremental) impact. Of very high priority should be

product research and social science (non-technological) research; process research should be of only medium priority. Anticipatory research is vital to prevent future environmental problems and can serve as a guide to this country's new product development and future consumer behavior; it should have high priority in Fiscal Year 1991 after the detailed program is developed.

5. The thrust of the product research area should be on a product's impact during use and disposal, as that is where new perspectives are needed.

6. The social science research should address changing of mind sets, removing barriers and disincentives, conceiving and prioritizing incentives, encouraging reduction in use of problem substances, and education at all levels. Expertise should be built up within the Agency, but the current shortage should not deter efforts; outside experts initially should be relied upon.

7. A continuing, well-funded core research program in pollution prevention is critical to support an overall EPA risk-reduction paradigm centered on preventing pollution.

These recommendations are made in the context that pollution prevention is one of the most important initiatives that EPA can take in the next decade.

We are pleased to have had the opportunity to be of service to the Agency, and look forward to your response on this report.

Sincerely,

Raymond C. Loehr, Chairman
Executive Committee
Science Advisory Board

Richard A. Conway, Chairman
Environmental Engineering Committee
Science Advisory Board

Joan Berkowitz, Chairperson
Pollution Prevention Subcommittee
Science Advisory Board

EPA-SAB-EEC-89-037

REPORT OF THE POLLUTION PREVENTION SUBCOMMITTEE OF THE ENVIRONMENTAL ENGINEERING COMMITTEE SCIENCE ADVISORY BOARD

REVIEW OF THE OFFICE OF RESEARCH AND DEVELOPMENT'S DRAFT POLLUTION PREVENTION RESEARCH PLAN: REPORT TO CONGRESS

September 29, 1989

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 a balanced, expert assessment of scientific matters related to problems facing the Agency. This report has not been reviewed for approval by the Agency; hence, the comments of this report do not necessarily represent the views and policies of the Environmental Protection Agency or of other Federal agencies. Any mention of trade names or commercial products does not constitute endorsement or recommendation for use.

ABSTRACT

The Pollution Prevention Subcommittee of the Environmental Engineering Committee of the EPA Science Advisory Board (SAB) has prepared a report on the Agency's Draft Pollution Prevention Research Plan: Report to Congress. The Agency's draft report to Congress provides an excellent framework for addressing the critical research elements to support a more comprehensive Agency-wide, multi-media pollution prevention initiative. A continuing, well-funded core research program in pollution prevention within EPA is critical to support the new EPA paradigm centered on preventing pollution, rather than on "end-of-pipe" treatment. The scope of the Report to Congress should be expanded to include more detail on management, organization and resource allocation, including commitment from the top, pollution prevention from non-industrial sources, relationships with the efforts of other Federal agencies and private sector sources, and ways to measure progress.

There should be a shift in priorities to initially emphasize those studies having the largest potential for developing bold, new initiatives which could have major impact. Very high priority should be given to product research and social-science (non-technological, socio-economic) research. Process research should be of only medium priority. The thrust of the product research area should be on a product's impact during use and disposal. The social science research should include investigation into the feasibility of changing societal attitudes, the effectiveness of removing barriers and disincentives, providing incentives for pollution prevention, encouraging reduction in use of problem substances and education at all levels. Expertise should be built up within the Agency, but the current shortage should not deter efforts. Outside experts should be relied upon.

Key Words: pollution prevention, pollution prevention research, Report to Congress.

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1.0 EXECUTIVE SUMMARY

This report presents the EPA Science Advisory Board's (SAB) review of the Office of Research and Development"s (ORD's) "Draft Pollution Prevention Research Plan: Report to Congress," dated February 15, 1989. The report was prepared in response to a specific request from Congress to submit "...a multi-year plan addressing the critical research elements to support an Agency-wide multi-media pollution prevention initiative..." This report is consistent with the recommendations of the SAB (7), in its September 1988 report to EPA entitled "Future Risk: Research Strategies for the 1990's", that the Agency shift the focus of its environmental protection strategy from "end-of-pipe" command and control measures to preventing the generation of pollution. The SAB further recommended that EPA plan, implement and sustain a long-term research program to support a new Agency-wide pollution prevention paradigm.

The ORD Draft Pollution Prevention Research Plan is well thought out and well prepared. The six prong program involves product research, process research, recycling and reuse research, technology transfer and technical assistance, non-technological research, and innovative research for future environmental problems. This program is comprehensive, broadly conceived and supportive of the stated goals of the Agency-wide pollution prevention initiative. The goals for each of the research program areas are innovative and point the way toward strategies and actions with high potential for major progress.

Subcommittee members transmitted specific comments and recommendations to representatives of ORD at a March 9-10, 1989 review. Major findings and recommendations are summarized below:

- Earlier Emphasis on Product Research and Social Science (Non-Technological) Research - After considering where science is lacking and where the potential for bold initiatives is greatest, the Subcommittee concluded that priorities should be as follows:

  -Very High Priority: Product Research and Social Science (Non-Technological) Research

  -High Priority: Technology Transfer and Technical Assistance

-Medium Priority: Process Research

-No Activity in FY 90: Recycling/Reuse and Anticipatory research[1].

- Anticipatory Research is Vital - Anticipatory research is vital to long-term effectiveness of the pollution prevention initiative and should have a higher priority in FY 1991 after a detailed program is developed.

- Non-Technological Research is Key - Such research is crucial, because a shift in strategy from "end-of-pipe" to "pollution prevention" will require a fundamental change in thinking, both within the EPA, and also in industry, other government agencies, academia and the public at large. Product, process and recycling/reuse research could result in a plethora of technically and economically feasible approaches for preventing pollution. Technology transfer and technical assistance could assure that potential users are made aware of the approaches developed or uncovered and fully understand them. None of this will make the slightest bit of difference, however, unless the ideas are translated into action. The socio-economic (i.e., non-technological) barriers to action and incentives for action are the areas where scientific knowledge is most lacking and where research can have a major impact. Public opinion, public awareness and public participation will fuel the entire pollution prevention effort. Market pressures on industry will result in more products manufactured by pollution prevention technologies.

- Product Research as a Bold New Initiative - ORD's stated goal for this area is to "Stimulate the development and use of products that result in reduced pollution." The Subcommittee commends this goal and congratulates ORD for clearly recognizing the product issue. However, the ORD draft report should address more clearly the pollution generated by the users of a product after the product leaves the manufacturing plant. The product may be used by an individual consumer or another industry as its feedstock. The product may be made by a low and non-polluting process. However, when it is being used by another industry, it could result in a second generation of industrial

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[1]. The Subcommittee recommends the term "Anticipatory Research" as a more appropriate heading than "Innovative Research for Future Environmental Problems," and uses the term "Anticipatory Research" throughout this report.

pollution in the user's factory. It could also become a very difficult disposal problem for the users. The same is also true if the product is used by an individual consumer. This kind of secondary pollution problem should be considered as a part of the pollution prevention research plan.

- System Needed to Measure Progress - The goals of the research program are written very broadly with no clearly defined endpoints. Thus, any judgment as to whether or not a goal has been achieved would be highly subjective. The objectives of each of the program areas are stated in such terms as "identify" and "facilitate", which are lacking in focus. The Subcommittee recommends that the plan include a means of quantifying progress, over and above determining whether research budgets are being met. The Subcommittee acknowledges that this is a difficult task, in part because the terms "waste" and "reduction" seem to defy definition in this draft report. We recommend, as an early research project, working with ASTM or some consensus standard-development organization to define terms and to establish specific ways of measuring progress.

- Commitment Needed at the Top - ORD staff confirmed that the research plan is only a small portion of a much larger pollution prevention initiative being undertaken by the Agency(6). The research plan would be strengthened by a "view from the top" -i.e., a vision articulated by the Administrator of what the world would look like when the research has been completed and how long it will take to get there. A vision that all could share would increase the chances of success. This vision must, however be realistic and admit there will always be residuals that must be properly disposed of. Pollution Prevention is important, but work in the area cannot be done at the expense of progress in the very important area of residuals management.

Top level commitment is important, not only within the Agency, but also within industry. The Subcommittee recommends that the Agency undertake a high level initiative, with leadership from the Administrator, to promote the pollution prevention message to all sectors. A plan should be offered, which evolves and refines over time, but which clearly sets goals and objectives from the top, seeking to obtain a like commitment from the top in the other sectors at all levels.

- Education Needed - Successful implementation of a national pollution prevention initiative will require well-trained environmental professionals who are fully indoctrinated in the principals of pollution prevention. A reasonably broad-based appreciation of the need for and benefits of pollution control now exists; however, pollution prevention, as a concept is not currently a component of most technical or social science curricula. New curricula or courses will not be needed. Rather, introduction of pollution prevention concepts and practices as components of existing curricula should enhance a transition to pollution prevention thinking.

- A Coordinating Role for EPA - The Subcommittee recommends that the Agency not shoulder the entire burden of pollution prevention research by itself. There are many interested and able parties outside of the Agency. An important role for the Agency is to build consensus and thereby get all of the parties to work together. Some consideration should be given to doing research in conjunction with industry and trade associations, other Federal and State agencies, and perhaps with international organizations. Environmental advocacy groups could play a part in the process by educating the public as to what each individual can do to prevent pollution.

- Non-Industrial Pollution Needs to be Addressed - The Report largely is aimed at preventing pollution from the processes and products of manufacturing industry. Major sources such as agricultural and mining practices need to be addressed, perhaps by coordinating efforts with other agencies.

- Issues of Management and Budget - A well-managed organization, supported by an adequate budget, is essential to implementation of the pollution prevention research plan and to coordination of that plan within the broader framework of an Agency-wide pollution prevention initiative. The report reviewed by the Subcommittee did not discuss either the budget level or the management and organization of the research program within the Agency. The Subcommittee recommends that a chapter be added to the report discussing resource allocation in some detail. This information is essential both for proper management of a major initiative within the Agency, and in order to be responsive to the request from Congress.

As stated previously, the draft Report defines an innovative approach to pollution prevention that is responsive to the Nation's needs; the recommendations suggested above are made in the spirit of improvement to a well conceived program structure.

2.0 INTRODUCTION

On December 1, 1988 Mr. Alfred Lindsey, Acting Director for the Office of Environmental Engineering and Technology Demonstration (OEETD), invited the Environmental Engineering Committee (EEC) of the Science Advisory Board (SAB) to review the draft Pollution Prevention Research Plan(PPRP) to Congress. The EEC accepted the invitation and formed the Pollution Prevention Subcommittee (PPS), with Dr. Joan Berkowitz as Chairman and Dr. C.H. Ward as Vice-Chairman.

The ORD Engineering Research Staff prepared a draft PPRP dated February 15, 1989 (5) for the PPS to review. The PPRP was accompanied by a statement on the project's background, and the specific charge for the SAB/PPS review (See Appendix A).

In response to a Fiscal Year 1989 Appropriations Bill passed by Congress, a report from the EPA on the Agency's Pollution Prevention Research Program (PPRP)is required. As the Agency set out to prepare a response to the mandate in the Appropriations Bill, it was determined that the term "pollution prevention" should be used in the broadest sense, referring to the reduction or elimination of pollutant discharges to the air, water, or land, and should not include either treatment or disposal. The report was intended to focus on the following activities:

a. Reducing the quantity and/or toxicity of pollutants generated by production processes through source reduction, waste minimization, and process modifications,

b. Eliminating pollutants by substituting non-pollutant chemicals or products (e.g., material substitution, changes in product specifications),

c. Recycling of waste materials (e.g., reuse, reclamation).

To prepare the Report to Congress, EPA's Office of Research and Development (ORD) held a workshop on November 9-10, 1988, to identify major research elements that would support an Agency-wide pollution prevention initiative. Workshop participants included representatives from industry, academia, state and local governments, public interest groups, various offices within EPA, and other Federal agencies. The workshop resulted in the identification of six major pollution prevention research goals and six research program areas. The results of the workshop and the efforts of an Agency-wide work group form the substantial basis of the research plan reviewed by the SAB's Pollution Prevention Subcommittee.

The six fundamental goals for the proposed pollution prevention research program are to:

(1) Stimulate the development and use of products that result in reduced pollution.

(2) Stimulate the development and implementation of technologies and processes that result in reduced pollution.

(3) Expand both the reusability and recyclability of products and the demand for recycled products in production processes.

(4) Identify and promote the implementation of effective non-technological approaches to pollution prevention.

(5) Conduct a vigorous technology transfer and technical assistance program that facilitates pollution prevention strategies and technologies.

(6) Establish a program of innovative research that will identify and address future opportunities.

To achieve the research goals, research areas were identified and priorities were established in the Agency's report. The report includes example research projects and implementation mechanisms. The program areas of the research plan expand and broaden ORD's research activities into evaluations of the technologies associated with products, processes, and recycling/reuse, and investigations of non-technological factors that influence pollution prevention, future innovative research, and technology transfer and technical assistance.

The ORD provided the preliminary draft research plan to the SAB's PPS for review and comment. The charge to the Subcommittee is linked to the SAB's September 1988 report, entitled "Future Risk: Research Strategies for the 1990's" (7,8). This report recommended that a primary long-term goal for the Agency should be a shift in environmental protection strategy from command and control "end-of-pipe" measures to preventing the generation of pollution. There are many areas which can not be controlled by typical "end-of-pipe" strategies. Examples include stratospheric ozone depletion, urban ozone, global climate change, groundwater protection, wetlands protection, municipal solid waste and oil and hazardous substance spills.

3.0 EVALUATION OF THE DRAFT POLLUTION PREVENTION RESEARCH PLAN

3.1 Responses to ORD's Major Questions

Overall, the draft Pollution Prevention Research Plan (PPRP) provides an excellent framework for addressing the critical research elements to support a more comprehensive Agency-wide multi-media pollution prevention initiative. In particular, the six-prong program specifying fundamental goals for the proposed pollution prevention research program is comprehensive and innovative. The goals point the way toward strategies and actions with a high potential for major progress.

3.1.1 Are There Adequately Identified Research Needs for Pollution Prevention?

The introductory portions of the document have some very good material on the need for pollution prevention research, but it is too long and sometimes repetitive. It is suggested that these portions be rewritten to state clearly the case for the importance of pollution prevention as the new operating paradigm for EPA. There should be further information in the report on how the work proposed by EPA will help to foster pollution prevention, and most importantly what will be accomplished.

The report uses the term "pollution prevention" to refer to source reduction and recycling of all environmental discharges in all environmental media. However, the proposed work is largely oriented toward industrial hazardous waste, building on current programs such as WRITE and WRAP. The Subcommittee cautions the Agency to steer clear of the normal tendency to build incrementally on existing (i.e., known and comfortable) programs in early years. Rather, the Subcommittee strongly recommends that the Agency take bold new steps early in the program.

The report should address all environmental discharges. Examples include integrated pest management and other farming strategies to reduce the use of pesticides and fertilizers, substitution of home products to reduce personal exposure to toxic substances and household hazardous waste generation, and strategies to reduce automotive pollution and promote water conservation and others). These examples are contained as part of the "Future Risk" recommendations (7,8). One way to expand the thinking beyond hazardous waste is to examine the potential effects of environmental discharges generated by the various

productive activities of man. It would be useful to do this on a sector-by-sector basis (e.g., agriculture, transportation, energy extraction and use, metals extraction and use, chemical and industrial production, etc.). A generic methodology as well as specific strategies for pollution prevention could evolve from this approach.

3.1.2 Is The Research Plan Appropriate?

The draft report focuses primarily on content of the proposed research program, and does not address program management and organization of the proposed program, or staffing and resource needs. The Subcommittee is in general agreement that the areas to be addressed are appropriate. However, the Subcommittee suggests modifications in specific program elements, and some shift in priorities as stated below and elsewhere within the text of this SAB report.

Based on discussion of where science is lacking and potential for bold initiatives is greatest, the Subcommittee recommends that serious consideration be given to changing the priorities among the research program areas. The following suggestions for priorities for initial years are recommended:

VERY HIGH PRIORITY

Non-technological research
Product research

HIGH PRIORITY

Technology transfer research and technical assistance

MEDIUM PRIORITY

Process research

NO ACTIVITY (First year)

Recycling and reuse research
Research on new problems (anticipatory research)

In summary, the shifts in research priorities leave product research, anticipatory research and technology transfer as recommended by the Agency, but suggest shifts in emphasis in the

other areas, for the following reasons:

Product Research: Should be a very high priority starting in year one. This has high potential and needs attention by the Agency, as others do not seem to be addressing it. The thrust of this research area should be more clearly associated with the product's impact once it is manufactured.

Process Research: Should be reduced from very high priority in initial years, to medium priority throughout the recommended program expenditure periods, as there is already much activity by industry in this area.

Recycling and Reuse Research: Should not start until later. This is recommended because this area is well-established. A lot of prior research has been done, and is being implemented commercially. More resources and attention should shift into areas where not much work has been done.

Socioeconomic/Institutional Research: This research should be raised to very high priority in year one, and it should be kept there throughout the program. This area needs serious attention, which can only occur with a sustained and substantial commitment.

Innovative Research: This should be redesignated as anticipatory research, and as the program is developed, be raised to a very high priority after the first year.

Technology Transfer: This should be high priority in the initial years.

3.1.3 Are The Research Goals Comprehensive and Achievable And Are The Objectives Focused Enough to Meet The Goals?

The six fundamental goals defined by ORD for the proposed pollution prevention research program are comprehensive. However, they are also very broad and have no clearly defined endpoints. Thus, any judgement as to whether or not a goal has been achieved would be highly subjective. The objectives for each of the program goals use such terms as "identify" and "facilitate," which are lacking in focus.

The Subcommittee recommends that the objectives be restated

so that they can serve as benchmarks for measuring progress. As formulated in the draft reviewed by the Subcommittee, the objectives are not sufficiently focused in terms of what is to be accomplished, in what time-frame, and with what commitment of resources.

The report contained no information about the magnitude of the program and the resources needed to carry out the plan. Dollar expenditures by year, accompanied by personnel (FTE) levels should be prominently displayed, accompanied by the logic to support those expenditure and staffing levels. Clearly, there should be an increase in FY 90 funding for research on pollution prevention. This increase has been advocated in previous reports (7,8).

3.1.4 Is The Scope of Each Research Topic Satisfactory?

The draft report introduces specific research topics by way of example. The Pollution Prevention Subcommittee members conveyed specific suggestions to the program staff on March 9 and 10 for revisions, modifications, additions, and deletions to the research topic examples. The suggestions are not repeated in this report, which focuses on more generic issues.

3.1.5 Are The Roles of EPA And The Public/Private Sector Identified Sufficiently?

The EPA should coordinate its efforts on pollution prevention with the work of other public sector agencies as well as private sector organizations. Agencies of note in the public sector include the departments of Agriculture, Defense, Energy, Transportation and Interior. Organizations of major significance which should be coordinated with on scientific issues include the National Academy of Sciences (NAS) and National Academy of Engineering (NAE), the National Science Foundation (NSF), as well as several trade associations. On the international front, there should be coordination with the Organization for Economic Cooperation and Development (OECD) and the United Nations Environmental Program (UNEP). The draft plan also should consider small business needs. Further, these small business needs with regard to pollution prevention should also be looked at within the other agencies.

The EPA should encourage the states and localities to have innovative programs in pollution prevention. State and local grants and other incentive-oriented programs should be looked at with regard to effective implementation of pollution prevention activities, and particularly with regard to enriching the various

approaches available to solve a given problem.

The report to Congress presents an important opportunity to indicate the entire federal strategy (not just EPA's) for pollution prevention. This could help focus attention on pollution prevention by the various federal agencies as well as leverage funding from other federal agencies and be more effective in the national effort. A coordinated research plan could include the following:

- Department of Agriculture - integrated pest management and fertilizer use reduction, non-point source pollution control,
- Department of Energy - energy conservation, energy efficiency, renewable energy sources, alternatives to coal and oil,
- Department of Defense - waste minimization from all its operations,
- Department of Housing and Urban Development - reducing indoor exposure to air pollution in new housing development.

While it is not possible to elaborate fully upon the interagency strategy as outlined above, the report to Congress could make a commitment to develop an interagency strategy and submit an amended report in a year. This would have EPA exerting an important leadership role in pollution prevention as a means of risk reduction across all agencies within the Executive Branch, as well as all sectors of society. A recent suggestion by the National Institute for Pollution Prevention at the University of Cincinnati that a White House Conference on Pollution Prevention be considered for 1991 has merit.

3.2 Other Issues Identified by the Subcommittee

3.2.1 General

It is clear that the Agency does not see the pollution prevention effort as being regulatory driven. They view it as a consensus building effort. The Subcommittee concurs that this gives the most chance for success. However, in order to get industry acceptance, the Subcommittee suggests that the Agency consider a high level initiative from the Agency to corporate America, preferably through trade organizations. Such a high level initiative will result in top down management of pollution prevention within industry, and thus maximize the probability of

success.

The research program should be restructured to put more emphasis on the socioeconomic/institutional research area. Current program emphasis views socioeconomic/institutional issues as a means to implement the products of the technological research. The Subcommittee believes that this is inappropriate. Public opinion, public awareness and public participation will fuel the entire pollution prevention effort. For example, developing public support up front will develop public demand for pollution prevention and for products manufactured via pollution preventing technologies. Market pressures on industry will result in more products manufactured with pollution prevention technologies. By not first addressing public attitudes on pollution prevention, we risk manufacturing many products with recycled materials that the public will be reluctant to purchase. If these products are not purchased, industry will stop manufacturing them and the initiative is lost. Public attitudes must be changed first.

The Agency may be reluctant to initiate the needed socioeconomic/institutional research effort. This is understandable, given the fact that such research is a radical departure from that most frequently undertaken by the Agency. The importance of the research area, however, is such that the effort cannot be delayed. Therefore, we believe that the Agency should recognize their lack of expertise in the area and embark on an aggressive program to develop expertise in the area. This could include interaction with academic and private expertise. The Agency should not be constrained by inside resources. As the Agency seeks bold new initiatives, it should look to the broader professional community as a logical component of the effort. There are many talented, dedicated people in academia, industry, research firms and private practice.

3.2.2 Anticipatory Research

The national program on pollution prevention should include a strong on-going component of high priority research designed to anticipate emerging and next-generation environmental issues that can best be addressed through pollution prevention. The Subcommittee suggests that the Pollution Prevention Research Plan: Report to Congress clarify this need in the report by changing the section title in Chapter 2 from Innovative Research to Anticipatory Research.

The critically needed effort to identify emerging problem areas on a timely basis could be coordinated with and/or modeled after the Agency's recently planned program of identifying anticipatory research needs in a broader context. In exercising

its leadership role in implementing the national program in pollution prevention, the Agency should ensure that other components of government (Agriculture (USDA), Department of Defense (DOD), Department of Energy (DOE), Department of Interior (DOI), Housing and Urban Development (HUD), etc.) are full participants in the program. In this way, such problems as non-point source pesticide runoff and radionuclide contamination of the environment can be approached through pollution prevention, rather than not at all, or by command and control "end-of-pipe" approaches.

This component should have a high priority, once promising project areas are identified.

3.2.3 Education for Pollution Prevention

Successful implementation of a national pollution prevention strategy initiative will require well-trained environmental professionals who are fully indoctrinated in the principals of pollution prevention. A reasonably broad-based appreciation of the need for and benefits of pollution control now exists; however, pollution prevention, as a concept is not currently a component of most technical or social science curricula. New curricula or courses will not be needed. Rather, introduction of pollution prevention concepts and practices as components into existing curricula will enhance rapid dissemination of pollution prevention information.

In the general American population, there is a lack of understanding of the importance of pollution prevention as it is impacted by everyday consumer practices. A higher level of environmental education is needed in all levels of society to develop a deep appreciation of the necessity for pollution prevention in the general public. Acceptance of pollution prevention as a way of life will require incorporation of new concepts in the existing curricula of elementary and secondary schools, as well as new efforts in general public education.

These needed educational efforts will require federal assistance, development of new instructional materials, and teacher training. EPA should work closely and cooperatively through training grants and other appropriate mechanisms with developers of instructional materials for elementary and secondary education and with colleges and universities to implement this high priority effort.

3.2.4 Commitment from the Top

In order to instill a proper sense of mission and importance, and the proper level of commitment to pollution prevention, a commitment must be made at the top in every organization. The report fails to show how the proposed research initiative into pollution prevention is being undertaken by the Agency, particularly as it relates to upper level commitment by Agency management.

It is suggested that the Agency consider a high level initiative, with leadership from the Administrator, to promote the pollution prevention message to all public and private sectors. Within the Agency, goals and objectives should be set with regard to pollution prevention to tie into the proposed research plan. In order for corporate America to accept such a program, the Agency should consider a high-level initiative through such mechanisms as trade organizations. A plan should be offered, which evolves and refines over time, but which clearly sets goals and objectives from the top, seeking to obtain a like commitment from the top in the other sectors (e.g.,corporate, trade organizations, academia, public sector). The previously cited White House Conference on Pollution Prevention could be a vehicle for implementation.

3.2.5 Socioeconomic Shifts

There are incentives and barriers from legislative requirements. The socioeconomic and institutional research program should include identifying and assessing incentives that may increase, as well as obstacles that may inhibit pollution prevention. In particular, it would be essential to identify and eliminate barriers to pollution prevention that might exist within existing regulatory practices. The draft report does not at all address the potential barriers or incentives as a result of legislative mandates. This would be most essential to have a perspective on the restrictions that the Agency has to deal with. It is understood that the Agency cannot change the legislative requirements without the cooperation of Congress and all affected/regulated parties. It is strongly recommended that the Agency , in its proposed research program, identify both the incentives and the barriers to effectively implement pollution prevention. The Agency should then make proposals for implementation along these lines.

3.3 Other Specific Comments

Product Research and Prevention of Pollution from Product Use

One pollution source which has not been addressed clearly in the draft report is the pollution generated by the users of the product after the product leaves the manufacturing facility. While the production of wastes associated with a product clearly needs to be considered, the thrust of the research area should be more clearly associated with a product's impact, once it is manufactured. For instance, the product may be used by an individual consumer or another industry as its feedstock. The product might be made by a low and/or non-polluting process. However, when the product is being used by another industry, it could generate a second generation of industrial pollution problems in the user's factory. It could also become a difficult disposal problem for the users. The same is also true if the product is used by an individual consumer. This kind of secondary pollution problem should be considered in the development of the new product as a part of the pollution prevention program.

Prevention of pollution from product use should be in the introduction of the research plan report to Congress as an additional pollution prevention approach. This also should be incorporated throughout the report in the subsequent chapters where appropriate.

Product research should include evaluation of the potential indirect and long-term effects of product reformulations and substitutes of all kinds. For example, in research on development of biodegradable products, potential adverse impacts of reformulation of plastics, to include biodegradability, should be assessed.

Process Research

The process research discussion on pages 2-9 to 2-11 of the draft report prompts the following comments. A key element related to process research on pollution prevention is a consensus definition of terms and a system for measuring progress. The terms, "waste" and "reduction" seem to defy definition; this hampers the development of true programs, although many hit-or-miss activities are still possible. Working with ASTM or some other consensus standard-development organizations would seem appropriate. This would have a major benefit across the industry. Once terms are defined, specific

ways of measuring progress should be established.

Process and recycle/reuse research can be expected to continue to give gradual benefits, but the non-technological and product areas may result in significant step changes due to the expected discovery of new knowledge in an unplowed area.

Recycling and Reuse Research

In order for recycling and reuse research to be a success, public attitudes must change. Given a choice, most people will select a new product over one made from recycled materials, even if it costs a little more. The perspective is that somehow "new" is better and will last longer.

It is a laudable concept to identify and evaluate new and innovative uses for materials that would otherwise be disposed of as waste. However, when Company A sends a waste to Company B for use in their process, when does Company A's responsibility cease and Company B's begin? If Company A's responsibility does not end when Company B takes control, then there will be little interest in the innovative exchange of waste materials. This is one instance where the cradle-to-grave management philosophy might be a hindrance.

4.0 CONCLUSIONS AND RECOMMENDATIONS

The major findings and recommendations of this review are summarized below:

1. The Draft Pollution Prevention Research Plan: Report to Congress provides an excellent framework for addressing the critical research elements to support a more comprehensive Agency-wide multi-media pollution prevention initiative.

2. A continuing, well-funded core research program in pollution prevention within EPA is critical to support the new EPA paradigm centered on preventing pollution. The SAB was not provided with planned dollar expenditures by year, accompanied by manpower (FTE) levels and the logic to support those expenditure and staffing levels. More information about the magnitude of the program and the resources needed to carry out the plan is necessary.

3. The scope of the report should be expanded to include more detail on the following:

    a. Management, organization and resource allocation, including commitment from the top

    b. Pollution from non-industrial sources

    c. Relationship with the efforts of other Federal agencies

    d. Ways to measure progress.

4. Priorities should be changed to emphasize early those studies having the largest potential for developing bold, new initiatives having major impact. Of very high priority should be product research and non-technological research; process research should be of only medium priority.

5. The thrust of the product research area should be on a product's impact during use and disposal, as that is where the new perspective is needed.

6. The non-technological research should address removing barriers and disincentives, providing incentives for pollution prevention, encouraging reduction in use of problem substances and education at all levels.

Expertise should be built up within the Agency, but the current shortage should not deter efforts. The outside experts should be relied upon. This section of the report needs expansion and more direction.

7. The Agency should move away from a tendency to build incrementally on existing programs in early years. The Agency is reminded that bold initiatives were suggested in the Risk Reduction Subcommittee of the SAB Research Strategies Committee (8). Examples are provided in the text of this report.

8. A key element related to process research on pollution prevention is a consensus definition of terms and a system for measuring progress. It is suggested that the terms such as "waste" and "reduction" be defined by working with ASTM or some other consensus standard-development organizations. Once terms are defined, specific ways of measuring progress should be established.

9. The Agency should not feel constrained by its own resources, and should look to the broader professional community. The Agency should seriously consider public-private partnerships in academia, in research firms, and in private practice as it seeks bold new initiatives.

10. The Report to Congress does not deal directly with the reduction in the use of toxic substances. This subject can be approached in many ways, and some suggestions are offered in the text of the report.

11. The Report to Congress presents an important opportunity to indicate what the entire federal strategy (not just EPA's) for pollution prevention is. This could help leverage funding from other federal agencies and be more effective in the national effort. For example, a coordinated research plan could include USDA, DOD, DOE, DOI, DOT, HUD, and other agencies. Additionally, organizations of major significance which should be coordinated with on scientific issues include NAS, NAE, NSF, OECD, UNEP, as well as several trade associations.

12. The Agency should consider developing an interagency and technology transfer strategy and submit an amended report to Congress. When it is done, it should be left to EPA to coordinate. This would have EPA exerting an important leadership role in pollution prevention as a means of risk reduction across all sectors of society.

13. The Agency should elevate the importance of pollution prevention related to emerging problems in Chapter 2 of the report, and retitle this Anticipatory Research. This could be modeled after the Agency's recently planned program of identifying anticipatory research needs in a broader context.

14. Successful implementation of a national pollution prevention strategy initiative will require trained pollution prevention specialists and a level of environmental education not currently present in the American population. Hence, a substantial augmentation of the current environmental education system will be required at all levels of society. New curricula or courses will not be needed; rather introduction of pollution prevention concepts and practices into existing curricula will enhance both acceptance and rapid dissemination of pollution prevention information. The educational effort needed will require federal assistance, development of new instructional materials, and teacher training.

15. Commitment at the top makes a difference. In order to instill a proper sense of mission and importance, and the proper level of commitment to pollution prevention, a commitment must be made at the top in every organization. The draft report fails to show how the proposed research initiative into pollution prevention is being undertaken by the Agency, particularly as it relates to upper level commitment by Agency management. It is suggested that the Agency consider a high level initiative, with leadership from the Administrator, to promote the pollution prevention message to all sectors. A recent suggestion by the National Institute for Pollution Prevention at the University of Cincinnati that a White House Conference on Pollution Prevention be considered for 1991 has merit. A plan should be offered, which evolves and refines over time, but which clearly sets goals and objectives from the top, seeking to obtain a like commitment from the top in the other sectors.

APPENDIX A - THE CHARGE TO THE SUBCOMMITTEE

The SAB's PPS was asked to formulate responses to the following general questions in conducting this review:

1. Are there research needs for pollution prevention? Are these adequately identified?

2. Is the research plan appropriate, considering the research needs or gaps?

3. Are the research goals sufficiently comprehensive and achievable?

4. Are the objectives focused enough to meet the goals?

5. Is the scope of each research topic satisfactory? If not, what additional areas should be addressed in this report?

6. Are there any major issues of significance presently not identified?

7. Are the roles of EPA and other public and private sector organizations identified sufficiently?

8. For future activities, are there other areas that ORD and the Agency program offices should focus upon?

APPENDIX B - GLOSSARY OF TERMS

ASTM-	AMERICAN SOCIETY OF TESTING MATERIALS
DOD-	U.S. DEPARTMENT OF DEFENSE
DOE-	U.S. DEPARTMENT OF ENERGY
DOI-	U.S. DEPARTMENT OF INTERIOR
DOT-	U.S. DEPARTMENT OF TRANSPORTATION
EEC -	ENVIRONMENTAL ENGINEERING COMMITTEE OF THE SCIENCE ADVISORY BOARD
EPA-	U.S. ENVIRONMENTAL PROTECTION AGENCY (ALSO USEPA)
FTE-	FULL TIME EMPLOYEES/FULL TIME EQUIVALENTS
FY-	FISCAL YEAR
HUD-	U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
ISWA-	INTERNATIONAL SOLID WASTE ASSOCIATION
NAE-	NATIONAL ACADEMY OF ENGINEERING
NAS-	NATIONAL ACADEMY OF SCIENCES
NSF-	NATIONAL SCIENCE FOUNDATION
NTC-	NATIONAL TOXICS CAMPAIGN
OECD-	ORGANIZATION FOR ECONOMIC COOPERATION AND DEVELOPMENT
OEETD-	OFFICE OF ENVIRONMENTAL ENGINEERING AND TECHNOLOGY DEMONSTRATION OF THE EPA/ORD
OPPE-	OFFICE OF POLICY, PLANNING AND EVALUATION OF THE U.S. ENVIRONMENTAL PROTECTION AGENCY
ORD-	OFFICE OF RESEARCH AND DEVELOPMENT OF THE U.S. ENVIRONMENTAL PROTECTION AGENCY
PIRG	PUBLIC INTEREST RESEARCH GROUP
PPRP-	POLLUTION PREVENTION RESEARCH PLAN (ALSO REFERRED TO AS THE DRAFT POLLUTION PREVENTION RESEARCH PLAN: REPORT TO CONGRESS, THE POLLUTION PREVENTION RESEARCH PLAN: REPORT TO CONGRESS, THE REPORT TO CONGRESS, THE RESEARCH PLAN, DRAFT REPORT, OR THE DRAFT PLAN)
PPS-	POLLUTION PREVENTION SUBCOMMITTEE OF THE ENVIRONMENTAL ENGINEERING COMMITTEE OF THE SCIENCE ADVISORY BOARD (ALSO REFERRED TO AS THE SUBCOMMITTEE)
SAB-	SCIENCE ADVISORY BOARD OF THE U.S. ENVIRONMENTAL PROTECTION AGENCY
UNEP-	UNITED NATIONS ENVIRONMENTAL PROGRAM
USDA-	U.S. DEPARTMENT OF AGRICULTURE
WRAP-	THE WASTE REDUCTION ASSESSMENTS PROGRAM
WRITE-	THE WASTE REDUCTION INNOVATIVE TECHNOLOGY EVALUATION (WRITE) PROGRAM

APPENDIX C - RESOURCE MATERIAL AND REFERENCES CITED

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3) Holden, Constance, "The Ecosystem and Human Behavior," Science, Vol. 242, p.663

4) Public Interest Research Group (PIRG) and National Toxics Campaign (NTC), Toxics Use Reduction from Pollution Control to Pollution Prevention, Policy Paper, February 1989

5) USEPA, Office of Research and Development, Draft Pollution Prevention Research Plan Report to Congress, February 15, 1989

6) USEPA, Proposed Pollution Prevention Policy Statement, Federal Register, Vol. 54, No. 16, January 26, 1989, pp. 3845-3847

7) USEPA, Science Advisory Board, Future Risk: Research Strategies for the 1990's, SAB-EC-88-040, September 1988

8) USEPA, Science Advisory Board, APPENDIX E: Strategies for Risk Reduction Research, SAB-EC-88-040E, September 1988