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

October 9, 1987

SAB-EEC-88-004

Honorable Lee M. Thomas
Administrator
U. S. Environmental Protection Agency
401 M Street, S. W.
Washington, D. C. 20460

OFFICE OF
THE ADMINISTRATOR

Dear Mr. Thomas:

The Science Advisory Board's (SAB) Environmental Engineering Committee (EEC) has completed its review of the Office of Research and Development's (ORD) Waste Minimization Strategy and is pleased to transmit its final report to you. This report resulted from: (a) a Committee meeting on May 11-12 at which time representatives from ORD, the Office of Solid Waste (OSW), the Congressional Office of Technology Assessment and North Carolina's Pollution Prevention Pays Program presented information on issues pertaining to waste minimization, and (b) the deliberations of a subcommittee of the EEC and the full EEC. The report was approved by the SAB Executive Committee on October 8th.

The Committee's report states a number of major conclusions and recommendations, including the following:

o Waste minimization deserves substantial visibility and commitment at the highest levels of the Agency. The ORD Waste Minimization Strategy is a modest, yet promising, response to several aspects of the Agency's Report to Congress: Minimization of Hazardous Waste. The ORD Strategy, however, is not an Agency-wide effort. The Committee views it as a more narrowly conceived program plan for a subset of topics. Although the Report to Congress is more comprehensive, it does not contain a clear approach for action, nor does it provide concrete program plans. ORD, OSW, and other offices within EPA should develop a more comprehensive waste minimization strategy, from which individual, yet coordinated, program plans can be designed. Even more generally, the waste minimization strategy should be developed in the context of an Agency-wide waste management strategy.

o A waste minimization strategy should not be restricted to "hazardous wastes" (as defined by EPA), to wastes that are land disposed, or only to substances traditionally viewed as "wastes." EPA's strategy should be broadly conceived to include any non-product substance, including solids, liquids and gases, that leaves a production process or a site of product handling or use. Such releases should include both point and diffused sources.

o The Committee recommends that, given current resources, EPA's waste minimization program can most productively focus upon waste prevention (source reduction), and waste recovery/reuse/recycling. The Committee agrees that waste prevention is the most desirable option.

o Medium-sized generators (plants that generate 10,000 to 100,000 kilograms of hazardous wastes per month) could benefit most from waste minimization technology-transfer efforts because they often are not aware of waste minimization options and because implementing promising waste minimization options at such plants could have a significant impact on waste generation nationally.

o It is important for EPA, private industry, and universities to work cooperatively to incorporate training in environmental issues into the curricula of a number of disciplines relevant to waste management and generation.

The Committee appreciates the opportunity to review this important research program. It requests a formal Agency response to its conclusions and recommendations.

Sincerely,

Norton Nelson
Chairman
Executive Committee

Raymond Loehr
Chairman
Environmental Engineering Committee

SAB-EEC-88-004

REVIEW OF

THE OFFICE OF RESEARCH AND DEVELOPMENT'S

WASTE MINIMIZATION STRATEGY

REPORT OF

THE ENVIRONMENTAL ENGINEERING COMMITTEE

OF THE

SCIENCE ADVISORY BOARD

U.S. ENVIRONMENTAL PROTECTION AGENCY

October 1987

NOTICE

This report has been written as 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 and, hence, the contents of this report do not necessarily represent the views and policies of the Environmental Protection Agency, nor of other agencies in the Executive Branch of the Federal government, nor does mention of trade names or commercial products constitute endorsement of recommendation for use.

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I. EXECUTIVE SUMMARY

This report presents the Science Advisory Board's review of the Office of Research and Development's (ORD's) "Waste Minimization Strategy" (Appendix A). As early as 1976, the Environmental Protection Agency (EPA) identified waste minimization as a desirable goal.[1] In response to the requirements of the 1984 Hazardous and Solid Waste Act (HSWA) Amendments the Agency has placed more emphasis on this option. EPA's recent efforts have resulted in the 1986 Report to Congress: Minimization of Hazardous Waste. (See summary sheet in Appendix B).

Preventing generation of wastes is important for many reasons. These include:

- o Pollution control technologies are not 100% efficient.
- o Some control technologies transfer contaminants to different environmental media.
- o Siting new waste management capacity is difficult.
- o Waste minimization offers direct and indirect economic benefits.

Although a few companies and a few states have aggressively pursued waste minimization, many have not. Interest in waste minimization is growing, however, as evidenced by an expanding number of reports, conferences, and legislative proposals devoted to this subject.

Waste minimization deserves substantial visibility and commitment at the highest levels of the Agency. The ORD Waste Minimization Strategy is a modest, yet promising, response to several aspects of the Agency's Report to Congress. The ORD Strategy, however, is not an Agency-wide effort. The Committee views it as a more narrowly conceived program plan for a subset of topics. Although the Report to Congress is more comprehensive, it does not contain a clear approach for action, nor does it provide concrete program plans. ORD, the Office of Solid Waste (OSW), and other offices within EPA should develop a more comprehensive waste minimization strategy* from which individual, yet coordinated, program plans can be designed. Even more generally, the waste minimization strategy should be developed in the context of an Agency-wide waste management strategy.

A waste minimization strategy should not be restricted to "hazardous wastes" (as defined by EPA), to wastes that are land disposed, or only to substances traditionally viewed as "wastes." EPA's strategy should be broadly conceived. In the context of waste minimization, waste should be defined as any non-product substance, including solids, liquids, and gases, that leaves a production process or a site of product handling or use. Such releases should include both point and diffused sources.

The Committee believes that waste minimization includes a variety of on- and off-site, in-process, and post-generation waste management options that

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*In this report, strategy means an articulation of a concept or goal and the types of activities necessary to implement the concept. A program, or program plan, is an articulation of the details of the specific projects, timetables, and funding necessary to implement a strategy or a component of a strategy.

reduce the hazard of a waste, including waste treatment. "Waste prevention," "waste reduction," and "source reduction" all appear to be synonyms for a subset of waste minimization practices that focus on in-process practices that prevent or reduce waste generation per se. The Committee believes that waste prevention (source reduction) deserves special emphasis. To avoid confusion on the desirability of various options, EPA should (in coordination with other interested parties) clarify the terminology used for waste minimization practices.

The Committee recommends that, given current resources, EPA's waste minimization program can most productively focus upon waste prevention (source reduction), and waste recovery/reuse/ recycling. The Committee agrees that waste prevention is the most desirable option. It is the option that the Agency's waste minimization program should strongly emphasize, but which has not been directly supported to date. From a practical standpoint, however, EPA may choose to include waste recycling and reuse in the program because, in many instances, this option will provide economic benefits to waste generators. The waste minimization research program should not include waste treatment because it is already addressed by other research programs.

The Committee concludes that initially focusing the program on hazardous waste prevention (source reduction) and recycling is reasonable. The goal of the program, however, must remain protection of human health and the environment, rather than changes that merely result in avoiding the regulatory classification of a "hazardous waste."

The Committee believes that medium-sized generators (plants that generate 10,000 to 100,000 kilograms of hazardous wastes per month) could benefit most from waste minimization technology-transfer efforts because they often are not aware of waste minimization options and because implementing promising waste minimization options at such plants could have a significant impact on waste generation nationally. Among medium-sized waste generators, the Committee believes that the emphasis of technology-transfer efforts should be on users of chemicals, as opposed to chemical manufacturers because users may lack the chemical engineering expertise to develop waste minimization approaches.

EPA should not, however, exclude larger companies from its public awareness efforts. Even though larger companies have greater financial and technical resources to pursue waste minimization without direct EPA involvment, many could benefit from Agency guidance on how to apply those resources toward meaningful efforts. In developing and implementing the Agency's program, EPA should continue to seek the assistance of more progressive companies that are actively implementing waste minimization. The experiences of such companies could also help their customers and other generators to begin waste minimization efforts.

A specific suggestion for waste prevention (source reduction) opportunities that should be encouraged by EPA, other than those suggested in the ORD Strategy, is the design of new products that will minimize waste generation by customers or users of these products such as solvent users.

Sectors that the Committee believes should not be the initial focus of EPA's waste minimization program include:

- o Smaller generators (facilities generating up to 10,000 kilograms of hazardous waste per month), because of the total quantities of waste they generate, both individually and in the aggregate.
- o Solvent recovery, which is already a well-established industry.
- o Electroplaters, for whom many innovative solutions have already been suggested in response to regulatory concerns.

The Committee concludes that the practice of conducting extramural research is sound; however, the Committee recommends against allocating limited resources for waste minimization research solely to specified university research centers. A competitive process (such as using Requests For Proposals, competitive grants, and unsolicited proposals, for example) will better assure ORD access to the best people in the various relevant fields, including those at universities. The Committee also recommends that research projects selected for funding have the possibility of some short-term applications, but not to the exclusion of longer-term, high-risk/high gain endeavors.

The Committee strongly believes that it is important for EPA, private industry, and universities to work cooperatively to incorporate training in environmental issues into the curricula of a number of disciplines relevant to waste management and generation. It is critical that much more integrated views of product design, production processes, waste generation, product handling and use, non-engineering approaches, cost-effectiveness, and pollution control that relate to waste minimization be developed in such fields as environmental, chemical process and petroleum engineering; business and economics; public policy; and law. Pollution control — much less environmental protection — cannot continue to be thought of only as "end-of-pipe" treatment. The integrated curricula that the Committee recommends would not require separate courses on topics such as source reduction and waste audits. Rather, the Committee recommends teaching the implications for waste generation of actions not traditionally associated with wastes.

EPA should work actively with groups such as the National Research Council, the National Science Foundation, the American Institute for Chemical Engineers, the Association of Environmental Engineering Professors, the Accreditation Board for Engineering and Technology, and the American Academy of Environmental Engineers to advocate such changes. EPA may also want to consider developing waste minimization resource materials that could be incorporated into courses, or encourage cooperative research between universities and industry through the design of selected projects or contracts.

The Committee recognizes that EPA expects to expand the funding of the waste minimization program four-fold (Appendix A, Option B) over the level considered when it was last reviewed under the Alternative Technologies Research Program.[2] Congressional activities on waste minimization [3,4,5] and on EPA research budgets also portend additional funding. The EPA research authorization bill,[5] for example, specifically recommends funds for waste reduction efforts (for state

grant programs and information dissemination). The Committee endorses this expanded support since it is likely to provide significant benefits, as demonstrated in a few pioneering efforts[6] (see also Appendix B).

In some instances, waste minimization offers not only better environmental protection but also economic savings. However, with the billions of dollars that this country spends each year on traditional hazardous waste control and clean up, EPA, the Office of Management and the Congress sould consider additional funding (beyond option B in ORD's Strategy) for this fundamentally important program -- the only Agency program that directly supports the most preferable waste management option.

The Committee believes that the proposed Federal facilities program (WREAFS) is cost-effective and has the potential to demonstrate important waste minimization alternatives. Government facilities include many industrial processes used elsewhere, and cooperation by other Federal agencies can facilitate access to operations. Joint projects also offer the opportunity to leverage EPA funds. Such projects should be pursued as soon as possible because they offer the prospect of short-term payoffs using only limited EPA funds.

The Committee agrees with the general consensus that much waste minimization and, in fact much waste generation prevention, can be achieved with existing technologies and methods[6,7] (see also Appendices A & B). Therefore, the proposed innovative technology program (WRITE) should definitely not be restricted only to "innovative" methods (and may need to be retitled). The Committee believes that the immediate challenge of waste minimization is to bridge the gap between the state-of-the-art and the state-of-practice. The ORD program should focus on (but should not be limited to) ways of obtaining information about currently available technologies and applications and directing them into the field, such as described in the proposed technical assistance program (WRTAP). In addition, the focus of these projects need not be on technical options per se, as many non-technical options can achieve significant results. The WRITE program should be implemented primarily through non-regulatory state programs.

The Committee strongly encourages the use of waste minimization audits. Such audits provide a systematic means of evaluating waste minimization opportunities at a plant. The Committee supports the development of an audit manual by ORD. Once this manual is complete, however, audit programs should be implemented by state programs, and ORD monies should be shifted to state and technical support.

The Waste Reduction Institute for Senior Executives (WRISE) should serve as a valuable resource. Not only should such individuals be able to provide early advice to the Agency and provide valuable real world perspectives, but they will also be able to serve as ambassadors for the program to help respond to the lack of information and fear of change that currently constrains waste minimization. The Institute should be established early in EPA's program.

II. INTRODUCTION

In January 1987, Dr. John Skinner, Director of the Office of Environmental Engineering and Technology Demonstration within EPA's Office of Research and Development, requested that the Science Advisory Board review ORD's Waste Minimization Strategy. The SAB Executive Committee accepted this request and assigned the review to the Environmental Engineering Committee (EEC) because of the EEC's experience, expertise, and interest in the topic. This review also followed an earlier EEC evaluation of waste minimization when it was a part of the Alternative Technologies Research Program.

On March 5, 1987 Dr. Thomas Hauser and Mr. Harry Freeman of ORD and Mr. James Berlow and Ms. Elaine Eby of the Office of Solid Waste introduced the Committee to their respective waste minimization activities. At a May 11-12 meeting, Dr. Hauser and Mr. Freeman presented more detailed information to the Committee and discussed specific questions for the Committee to consider (see Appendix C). At the May 12 meeting, the Committee also discussed waste minimization with representatives from the Office of Solid Waste, the Congressional Office of Technology Assessment (OTA), and North Carolina's Pollution Prevention Pays Program.

The Committee requested additional information from ORD and OSW and formed a subcommittee to continue deliberations and write a draft report. The membership of the Subcommittee and the entire Committee appears in Appendix D. The Subcommittee's report was discussed and approved by the full Committee and subsequently by the SAB Executive Committee on October 8.

III. EVALUATION OF THE ORD WASTE MINIMIZATION STRATEGY

A. General Comments

The ORD Waste Minimization Strategy is a modest, yet promising, attempt at responding to several aspects of the Agency's 1986 Report to Congress: Minimization of Hazardous Waste. The ORD Strategy, however, is not an Agency-wide effort. The Committee views it as a more narrowly conceived program plan for a subset of topics. Although the Report to Congress is somewhat more comprehensive, it does not contain a clear approach for action, nor does it provide any concrete program plans. ORD, OSW, and other offices within the Agency should work cooperatively to develop a more comprehensive waste minimization strategy, from which individual, yet coordinated, program plans can be designed. The Committee also believes that the Agency should develop an EPA-wide waste minmization strategy while development of the ORD waste minimization program progresses.

A waste minimization strategy should not be restricted to hazardous waste. Although EPA efforts respond to the current, limited legislative requirements on the minimization of hazardous waste, the strategy should be broadly conceived. A narrower focus creates the opportunity to merely shift pollution outside of the defined focus, and to miss other substances that may be more important to control or reduce. For waste minimization, waste should be defined as any non-product substance, including solids,

liquids, and gases, that leaves a production process or a site of product handling or use. Such releases should include both point and diffused sources.

The Agency's waste minimization efforts should be designed within the broader context of all types of waste management. The Committee strongly advocates a more integrated and hierarchical view of waste management that includes (in order of the most preferable):

(1) Waste Prevention (or Source Reduction): prevention (or reduction) of waste generation at the source, through improved management practices or through changes such as process modification, product reformulation, new product design, and input substitution. (This is similar to OTA's use of the term "waste reduction").[6,7]

(2) Waste Recycling and Reuse: on-site or off-site beneficial use of "wastes" in any manner, for example, recovery of raw materials or energy.

(3) Waste Treatment: any type of process (including various chemical, physical, thermal, and biological processes) designed to substantially reduce the potential harmful effects (not only toxicity) of a substance on human health or the environment.

(4) Disposal of Final Residues: only a very few practical treatment processes can convert 100 percent of a waste into harmless compounds. There will continue to be residues that must be properly disposed.

This approach is reasonably consistent with the Agency's 1976 (pre-RCRA) policy statement[1] that emphasizes waste reduction as most desirable and land disposal as least desirable. In practice, however, Agency programs have not emphasized waste prevention (source reduction), nor has EPA regularly considered cross-media impacts.

Because any comprehensive waste management strategy, including a waste minimization strategy, consists of so many different types of substances and types of pollution, it should be an Agency-wide strategy. Many parts of the Agency will have a role in such a broad-based strategy. In addition, waste minimization requires a fundamental shift in attitudes and perceptions. These shifts are unlikely to occur without an agressive, visible, and proactive Agency commitment. The Committee believes that, given current resources, EPA's waste minimization research program can most productively focus upon waste prevention (source reduction) and recovery/reuse/recycling. Waste prevention is the option that has not been directly supported to date. The program should not include treatment research because it is already addressed by other ORD research programs.

The Committee also believes that initially focusing the program on hazardous waste reduction and recycling is reasonable because: (a) useful information has already been generated in response to hazardous waste management requirements; (b) the focus of OSW's Report to Congress is hazardous

wastes; and (c) there are often economic incentives to avoid hazardous waste regulations. Focusing on hazardous waste, however, does not mean that the goal of the program is to affect changes that produce substances that are no longer legally classified as "hazardous," yet may create harmful effects. The goal of the program must remain protection of human health and the environment.

B. Specific Responses to ORD's Questions

Appendix C identifies eleven questions that the Office of Research and Development has asked the Science Advisory Board to address. The responses below are organized by question number, as they were submitted.

1. Definitions and Focus

The Committee supports a broad definition of waste minimization as presented by ORD to mean "any reduction of wastes going to disposal — whether through source reduction, through on-site or off-site recycling, or even through treatment of wastes to reduce volume, mass, or toxicity (or other hazard)". As discussed earlier, the Committee strongly advocates a more integrated and hierarchical view of waste management.

Although all waste management alternatives are important, the Committee strongly believes that EPA's waste minimization program should focus on the most desirable option: waste prevention or reduction (as discussed above). From a practical standpoint, EPA may choose to include waste recovery, recycling and reuse in the program because, in many instances, this option will also provide economic benefits to waste generators. The waste minimization program should not include waste treatment, which is addressed by other research programs, and should not duplicate recycling/reuse programs that are well established.

To avoid confusion on the desirability of various options, the Committee recommends that EPA (in coordination with other interested parties) clarify the terminology used for waste minimization practices. For example, "waste reduction" and "source reduction" are apparently used interchangably. The Committee prefers the use of the term "waste prevention" for such practices.

2. Initial Emphasis - By Industry, By Size?

The Committee recommends that all sizes and types of generators (including government facilities, such as those of the Department of Defense and Department of Energy) should be included in this program. The fragmentation of large companies into individual operating plants with virtual autonomy may make size a less relevant factor.

To establish initial priorities within a waste minimization program, EPA should consider establishing criteria for selecting specific waste streams and/or industrial sectors. The EPA should also seek cooperative R&D projects with Department of Defense, Department of Energy, and other government facilities.

As a starting point, the Committee believes that medium-sized generators (plants that generate 10,000 to 100,000 kilograms of hazardous wastes per month) could benefit most from waste minimization technology-transfer efforts because they often are not aware of waste minimization options and because implementing promising waste minimization options could have a significant impact on waste generation nationally. Among medium-sized waste generators, the Committee believes that the emphasis of technology-transfer efforts should be on users of chemicals, as opposed to chemical manufacturers because users may lack the chemical engineering expertise to develop waste minimization approaches. A specific suggestion for waste prevention (source reduction) opportunities that should be encouraged by EPA, other than those suggested in the ORD Strategy, is the design of new products that will minimize waste generation by customers or users of these products, such as solvent users.

EPA should not, however, exclude larger companies from its public awareness efforts. Even though larger companies have greater financial and technical resources to pursue waste minimization without direct EPA involvment, many could benefit from Agency guidance on how to apply those resources toward meaningful efforts. In developing and implementing the Agency's program, EPA should continue to seek the assistance of more progressive companies that are actively implementing waste minimization. The experiences of such companies could also help their customers and other generators to begin waste minimization efforts.

EPA could consider targeting industries that use chemicals, but have little expertise in the chemistry of waste management. Such industries include the aerospace, electronics and metal fabrication industries. In addition, EPA may want to consider the feasibility of implementing waste minimization practices by initially selecting companies or industries. By beginning in industries that are most receptive, and on processes likely to generate positive results, EPA can establish a solid foundation for its program.

Sectors that the Committee believes should not be the initial focus of EPA's waste minimization program include:

- o Smaller generators (facilities generating up to 10,000 kilograms of hazardous waste per month), because of the total quantities of waste they generate, both individually and in the aggregate.
- o Solvent recovery, which is already a well established industry.
- o Electroplaters, for whom many innovative solutions have already been suggested in response to regulatory concerns.

3. WRITE Program - Evaluation and Demonstration Projects

Successful waste prevention (source reduction) experiences will be a useful component of an Agency program. Most of the initial benefits will be achieved with existing technologies but may be small in relation to total waste generation.

Data bases containing information about such efforts should continue to be developed. In addition to existing technologies, however, the waste minimization research program should maintain some recognition that new technologies and other scientific and engineering advances may be important to longer-term efforts and may ultimately have a greater impact (see #8, below).

The Committee agrees that a reluctance by some companies to disclose the details of successful methods is a difficult problem. For waste prevention (source reduction) efforts that involve commercially proprietary information, there is probably little hope of obtaining disclosure of such information. In other instances, however, EPA should consider positive publicity (such as EPA or Presidential awards) as a potentially important incentive for companies to disclose successful methods. A good and workable audit protocol should also reduce industry's concern about EPA's efforts (see #10, below).

4. WRRS Program - EPA-Funded University Research Programs

The Committee believes that the practice of conducting extramural research is sound; however, it recommends against giving its limited waste minimization resources only to two research centers. The Committee believes that a competitive process (such as using requests for proposals, competitive grants, and unsolicited proposals) will better assure ORD access to the best people in the various relevant fields. It also recommends that some of the research projects selected for funding have the possibility of some short-term applications (see #8, below), although the Committee does not underestimate the importance of longer-range high risk/high gain endeavors. The maximum proposed funding ($300,000 per year) would support, at most, three technically sound, creative, and useful research projects.

5. University Curricula

The Committee strongly believes that it is important for EPA, private industry, and universities to work cooperatively to incorporate training in environmental issues into the curricula of a number of disciplines relevant to waste management and generation. It is critical that much more integrated views of product design, production processes, waste generation, product handling and use, non-engineering approaches, cost-effectiveness, and pollution control that relate to waste minimization be developed in such fields as environmental, chemical process and petroleum engineering; business and economics; public policy; and law. Pollution control--much less environmental protection --cannot continue to be thought of only as "end-of-pipe" treatment.

Most engineers are trained narrowly, often to optimize only one objective such as product yield or removal efficiency. Within some disciplines, there may be no understanding of pollution issues as an important social and economic consideration, even in the traditionally narrow context of facility or process design.* Process diagrams should not show "waste" as an unidentified, undescribed arrow with no fate. Exogenous flows must be considered and system boundaries must be designed to include them.

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* For example, at ORD's waste minimization workshop,[8] one participant recounted meeting with a recent class of graduating chemical engineers, in which not one student knew the meaning of the acronym "RCRA," the statute that authorizes much of this nation's hazardous waste regulations.

The integrated curricula that the Committee recommends would not require separate courses on topics such as source reduction and waste audits. Rather, it recommends teaching the implications for waste generation of actions not traditionally associated with wastes. This should no more be an add-on to traditional curricula than pollution control should be an add-on to traditional production.

In order to encourage enlightened educators to expand the areas of inquiry for future students, many organizations must actively promote a broader view. EPA should work actively with groups such as the National Research Council, the National Science Foundation, the American Institute for Chemical Engineers, the Association of Environmental Engineering Professors, the Accreditation Board for Engineering and Technology, and the American Academy of Environmental Engineers to advocate such changes. EPA may also want to consider developing waste minimization resource materials that could be incorporated into courses, or encourage cooperative research between universities and industry through the design of selected projects or contracts.

6. Allocation of Resources

The Committee reviewed two alternative funding proposals (see Appendix A). Both proposals involved $12.8 million over three years, with approximately 7 to 9 people (FTEs) per year. These proposals included only funding for EPA's Office of Research and Development (much of which would be passed on to state programs). The table below summarizes ORD's "Option B" and the Committee's recommendations. The Committee developed its recommendations as percentages. The bullets after the table briefly discuss the recommendations:

Proposed Budget for ORD Waste Minimization Strategy
(see Appendix A)
($1000s, Fiscal Year 1988)

Program	ORD Proposal	SAB Recommendation*	
WRITE (Innovative Technology)			
Large Projects	100	285	(State Support)
Sb WRITE	300		
Analytical Methods	0		
R&D Support	0	30	(ORD Support)
(Total WRITE)	400	315	(35%)
WREAFS (Federal Facilities)	50	90	(10%)
WRAP (Audit)	400	0	(0%)
WRRS (Research)	0	180	(20%)
WRTAP (Technical Assistance)	0	270	(30%)
WRISE (Senior Executives)	50	45	(5%)
TOTAL:	900	900**	

* Note discussions in text about recommended nature of some programs.
** See text below

- o As noted previously, the Committee believes that the WRITE program should address facilities other than small generators.

- o As discussed below (in response to Question 8), the WRITE program should not be restricted to only innovative methods.

- o As shown in the table, the Committee endorses implementing WRITE projects by providing support to the states. State waste minimization and technical assistance programs, particularly non-regulatory programs such as the one in North Carolina reported to the Committee, have been very effective. Such programs can be tailored to local problems. In addition, industry is often more willing to work with such programs than with EPA.

- o The Committee believes that the WREAFS program is cost-effective and has the potential to demonstrate important waste minimization alternatives. Government facilities include many industrial processes used elsewhere, and cooperation by other Federal agencies can facilitate access to operations. Joint projects also offer the opportunity to leverage EPA funds. Such projects should be pursued as soon as possible because they offer the prospect of short-term payoffs using only limited EPA funds.

- o The Committee believes that funds should be shifted from the WRAP program to more general technical assistance (WRTAP) after the waste minimization audit protocol is completed in Fiscal Year 1987 (see Section C, "Other Issues").

- o The WRRS program was discussed in response to Question 4.

- o The WRISE program is discussed below in response to Question 11.

The Committee recognizes that EPA expects to expand the funding of the waste minimization program four-fold (Appendix A, Option B) over the level considered when it last reviewed this program as part of the Alternative Technologies Research Program. Congressional activities on waste minimization [3,4,5] and on EPA research budgets also portend additional funding. The EPA research authorization bill,[5] for example, specifically recommends research funds for waste reduction efforts (for state grant programs and information dissemination). The Committee endorses this expanded support since it is likely to provide significant benefits, as demonstrated in a few pioneering efforts.[6] (See also Appendix B).

In some instances, waste minimization offers not only better environmental protection, but economic savings as well. However, with the billions of dollars that this country spends each year on traditional hazardous waste control and clean up, EPA, the Office of Management and Budget and the Congress should consider additional funding (beyond Option B in ORD's Strategy) for this fundamentally important program--the only Agency program that directly supports the most preferable waste management option.

7. Outputs of the WRITE Program

Because a lack of information on waste minimization opportunities is a major constraint for industry, dissemination of the information generated by this program is critical; however, the Committee believes that conducting research projects as open public demonstrations does not serve any important purpose. Availability of project descriptions and results, in conjunction with other technical assistance activities, is sufficient. The output data from the WRITE program should undergo the Quality Assurance/Quality Control (QA/QC) process and third party evaluations to ensure its usefulness.

8. Emphasis on "Innovative" Methods?

Much waste minimization and, in fact much waste prevention, can be achieved with existing technologies and methods.[6,7] (See also Appendices A & B). Thus, the WRITE program should not be restricted only to "innovative" methods. The immediate challenge of waste minimization is to bridge the gap between the state-of-the-art and the state-of-practice. The ORD program should focus upon (but not be limited to) the means for identifying and evaluating opportunities, and transmitting information about currently available technologies into the field. In addition, the focus of these projects need not be on technical options per se, as many non-technical options can achieve significant results (e.g., good housekeeping and inventory practices).

It is possible, however, that the kinds of waste prevention measures that produce early results may not produce the most significant results. For example, some experts believe that important results will come from major process changes that will take at least five years to develop and implement.[9] Furthermore, a major process change is a high risk/high gain endeavor. The WRITE program should include some innovative and long-term projects and address ways to encourage industry to undertake such endeavors.

9. Any Significant Areas Related to Technical Barriers Not Addressed?

Specific needs not addressed by the ORD Strategy include existing product reformulation, new product design, developing information on the true costs (including potential liability costs) of waste management options, and implementation issues. These needs may not be a part of a waste minimization research program, but are relevant to an overall EPA waste minimization program.

Another significant area that has not been addressed is development of criteria for success. How will the EPA know that the program has been successful? Some kind of data base needs to be kept to document how much waste prevention has occurred, in what industries, for what waste, and by what methods. It will be a major research task to develop methods of measuring waste minimization.

More generally, as discussed above, the Committee is concerned about the potential for the strategy to be too narrowly focused. The Agency should consider waste minimization in the broadest context, including consideration of non-hazardous wastes and consideration of non-technical barriers and solutions. There is nothing wrong with a program that focuses on certain

aspects of a broader problem; however, without a broader strategy, it is impossible to tell whether the selected aspects are the most important ones. In addition, without a broader strategy, the linkage between important components may be missing.

10. Involvment of Regulatory Agencies

The Committee believes that industry's concern about enforcement problems from regulatory agencies is an important constraint. This real or perceived concern can inhibit participation in waste minimization activities, not only by industries whose compliance is poor, but also by those that have good compliance records. To the extent possible, this program should be implemented through non-regulatory state agencies. State waste minimization programs that have been implemented through non-regulatory groups, such as North Carolina's program, have achieved good progress in encouraging waste minimization.

Additional suggestions to reduce such fears include written agreements for demonstration projects; avoiding identification of specific facilities when documenting results; establishing broad-based cooperative projects among universities, agencies, consulting engineers, and industry; using "Senior Executives" (see below) to promote the program; and simply avoiding reluctant facilities initially and, instead, focusing on more forward-looking companies that are willing to participate. After the program establishes a positive track record, such problems should diminish.

11. Merits of the Proposed WRISE

The Waste Reduction Institute for Senior Executives should serve as a valuable resource. Not only should such individuals be able to provide early advice to the Agency and valuable real-world perspectives, they will be able to serve as ambassadors for the program to help respond to the lack of information and fear of change that constrains waste minimization. The Institute should be established early in EPA's program. Members should include actively employed individuals. Retired persons can provide valuable insights based on their experience and the perspective gained by their removal from day-to-day responsibilities. Industrial and high-level environmental or chemical process management experience should be stressed.

The Committee is divided on recommendations for the best affiliation for such an institute. Some members recommend housing the Institute in a governmental organization, such as EPA's Office of Research and Development. Others support affiliation with professional or scientific organizations such as the National Research Council or the National Science Foundation. Caution is recommended, however, in housing the Institute in a trade organization or professional society with a bias towards and substantial interest in perpetuating the traditional engineering approaches to (and preferences for) end-of-pipe pollution control. Other members recommend that the Institute be an independent body. The Institute's affilation should be designed to make it a prestigious entity, which the Committee believes is important to industry's willingness to consider EPA's advice on waste minimization.

C. Other Issues Identified by the Committee

1. Waste Minimization Audits

The Committee strongly encourages the use of waste minimization audits.* Such audits provide a systematic means for evaluating waste minimization opportunities at a plant. The Committee supports the development of an audit manual by ORD. Once this manual is complete, however, audit programs should be implemented by state programs, and ORD monies should be shifted to state and technical support. ORD should consider the potential problems created by inexperienced or unqualified "auditors." Development of auditor qualifications or certification may be a way to reduce such problems. The Committee also supports ORD's use of the audit review/advisory committee. That committee is well-constituted and should provide ORD with constructive advice.

2. Non-Technical Barriers

The most immediate barriers to waste minimization efforts are non-technical issues, such as proper economic analysis and institutional, organizational, behavioral, and informational barriers. [6,7] (see also Appendices A & B). ORD should consider a potential role in these areas, particularly in developing and making available for general use engineering cost data for waste minimization alternatives.

Economic factors are clearly a critical consideration in business decisions. EPA should re-evaluate its waste minimization program to ensure that adequate cost data on waste management alternatives are available and accessible. Such costs should include full and indirect costs, such as potential environmental liabilities and start-up costs.

3. Developing Consensus Standards

The emerging field of waste minimization needs consensus standards. Section B of this report, for example, discusses the need for consistent and clear terminology. How to count and track waste minimization and more complete cost accounting (e.g, to include liability costs) are other issues potentially amenable to discussion by consensus standards groups.

4. Waste Management Information Systems

Related to the last two issues is the need for better evaluation and planning by waste generators. Waste minimization audits are certainly one means to make a one-time evaluation. More continuous and detailed tracking of wastes could be achieved by waste management information systems. ORD may want to consider the usefulness of and feasibility of developing such systems.

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*The term audit is often used to describe a comparison to accepted guidelines or standards. In the context of waste minimization, however, audits are a more general evaluation designed to highlight waste minimization opportunities.

United States
Environmental Protection
Agency

Hazardous Waste Engineering
Research Laboratory
Cincinnati, OH 45268

APPENDIX A

Research and Development

EPA

Waste Minimization Strategy

BRIEFING DOCUMENT

BRIEFING DOCUMENT

WASTE MINIMIZATION STRATEGY DOCUMENT

Introduction

This document outlines and explains a proposed strategy for converting into action some of the proposals contained in the EPA's Report to Congress--Minimization of Hazardous Waste, submitted to the Congress in October 1986. The programs proposed in this Strategy are designed to contribute to the reduction of technical barriers identified by the EPA as impeding the adoption of waste minimization in the U.S. The Strategy does not address regulatory and economic barriers, the other two types of barriers highlighted by the Agency in the Report to Congress.

Background

There is a national policy in the United States to eliminate the generation of hazardous waste. The U.S. Congress stated in the Hazardous and Solid Waste Amendments of 1984 to the Resource Conservation and Recovery Act of 1976:

> The Congress hereby declares it to be the national policy of the United States that, wherever feasible, the generation of hazardous waste is to be reduced or eliminated as expeditiously as possible. Waste that is nevertheless generated should be treated, stored or disposed of so as to minimize the present and future threat to human health and the environment.

Reflecting the intent of this policy, there have been adopted by the EPA and other public agencies similar variations of the hierarchy shown below as a guide for hazardous waste management options:

1. Source reduction: reduce the amount of waste at the source through changes in industrial processes;

2. Waste separation and concentration: isolate hazardous materials from mixtures in which they occur;

3. Waste exchange: transfer wastes through clearinghouses so that they can be recycled in industrial processes;

4. Energy/material recovery: reuse and recycle wastes for the original or some other purpose, such as for materials recovery or energy production;

5. Incineration/treatment: destroy, detoxify, and neutralize wastes into less harmful substances; and

WASTE MINIMIZATION STRATEGY DOCUMENT

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5. Incineration/treatment: destroy, detoxify, and neutralize wastes into less harmful substances; and

6. Secure land disposal: deposit wastes on land using volume reduction, encapsulation, leachate containment, monitoring, and controlled air and surface/subsurface water releases.*

The term "waste minimization" has been defined differently by different organizations. The USEPA, in its October 1986 Report to Congress on the minimization of hazardous waste, defined waste minimization as:

> The reduction, to the extent feasible, of hazardous waste that is generated or subsequently treated, stored, or disposed of. It includes any source reduction or recycling activity undertaken by a generator that results in either: (1) the reduction of total volume or quantity of hazardous waste or (2) the reduction of toxicity of hazardous waste, or both, so long as the reduction is consistent with the goal of minimizing present and future threats to human health and the environment.

In addition to the EPA Report to Congress, other studies by the Office of Technology Assessment, the EPA's Science Advisory Board, the National Research Council and others have shown general agreement that an EPA program to encourage industry to accelerate its efforts to reduce the generation of wastes should be an important Agency objective. EPA's efforts should support and catalyze both the development and industry acceptance of industrial manufacturing and production techniques and recycling methods (both in-process and otherwise) that will produce less waste and/or less-hazardous waste for treatment and disposal.

At least ten of the states have initiated rather significant programs to encourage industries within their boundaries to reduce waste generation. Most of the ideas contained in this proposed Agency strategy are based on successful programs that have been undertaken by the various states. Consequently, the programs and experiences of these states will be utilized by the Agency in structuring the federal programs proposed in this document. The success of this strategy will be based to a great extent on the success of the Agency in incorporating the states as partners in the effort.

Although it is really quite difficult to know with certainty how much industrial waste could be eliminated through stepped-up waste minimization programs, it is strongly suspected that the amounts are very significant. The EPA Report to Congress contained data that suggested that, in general, industry could still reduce their hazardous waste streams by 20 to 30 percent. The EPA and OTA policy studies include many examples of successful waste minimization activities. The Massachusetts League of Women Voters has compiled reports regarding 20 to 30 of the major companies in the country that show that waste minimization on the order of 30 to 50 percent is not at all out of the ordinary when waste minimization has been actively supported by a company's management. The OTA has suggested that a goal of 10 percent waste reduction annually for the next 5 years for the country as a whole is not beyond achievement.

*This six-point hierarchy is contained in 41 FR 35050, August 18, 1976.

Whatever the EPA does in this area, it will be done with full consideration of the proprietary and free enterprise nature of U.S. industry. If hazardous waste generators, i.e., a broad segment of the industrial community of this nation, do not cooperate and participate, there will not be much accomplished. In addition, if environmental groups and the public sector are not informed and involved, the public's expectations may well exceed practically achievable results or, on the other hand, waste minimization may somehow be construed by these groups as "avoiding pollution control responsibilities."

The Current EPA Waste Minimization Program

Office of Solid Waste. For the past two years, the Office of Solid Waste (OSW) has been actively involved in the area of waste minimization. In October of 1986, the EPA submitted the Report to Congress on the minimization of hazardous waste. The report was the culmination of an extensive study conducted by OSW on source reduction and recycling techniques, the two primary elements of waste minimization. The goal of this study was to profile current waste minimization practices by the industrial sector and make estimates on current and future trends in waste minimization. In addition, the study identified the current incentives and disincentives (i.e., economic, regulatory and technical) which exist for waste minimization.

For the next several years, the OSW will be developing and implementing the Agency's waste minimization program which was introduced in the Report to Congress. The goal of this program is to promote the national policy established in the Hazardous and Solid Waste Amendments of 1984 regarding the minimization of hazardous waste.

As it is presently structured, the program has two principal objectives: (1) evaluate the need for regulations for waste minimization and present this evaluation along with appropriate recommendations in a report to Congress in 1990; and (2) foster the use of waste minimization through technology transfer and information dissemination activities. In order to achieve this goal, OSW has developed its FY87 and FY88 programs to focus on the tasks of gathering information and data to establish trends in waste minimization and developing information dissemination/technology transfer activites.

Office of Research and Development. The Office of Research and Development (ORD) has supported a small waste minimization extramural program over the past few years, cooperated with the states of North Carolina and Minnesota in supporting programs to assist small businesses to minimize their wastes and cooperated with the Governmental Refuse Collection and Disposal Association (GRCDA), a trade association concerned with providing technical assistance to small waste generators. Modest funding for the two state and trade association cooperative agreements has totaled $420K over two fiscal years. Matching funds by the states has brought a significant increase in the funding to allow for a substantial federal-state-private sector relationship.

ORD has also provided rather substantial support to one of the Agency's Centers of Excellence, the Illinois Institute of Technology (IIT), to support fundamental research into industrial waste elimination. The EPA has also cooperated closely with the Tufts Center for Environmental Management to

support various waste minimization studies and conferences. HWERL projects to evaluate various recycling options in the printed circuit board industry and several smaller projects to carry out waste minimization audit studies at five manufacturing facilities have recently been completed. Currently, as a continuation of the audit studies program, the ORD is supporting the development of a manual to be used in carrying out waste minimization audits. Funding for the audit program has remained constant at approximately $200K per year for the past two fiscal years. The IIT program has expended some $1.5 million since 1978 to support many broad-scale waste elimination research projects and some $250,000 has been provided by the Agency to the Tufts Center to support waste minimization projects.

EPA Report to Congress

The aforementioned EPA Report to Congress concluded that while mandating performance standards was not required at this time, "aggressive action in favor of waste minimization is clearly needed." The report recommended an approach based on a core waste minimization program, information gathering, and some longer-term options. The core waste minimization program is a seven-point program. Four of the points relate directly to dissolving technical barriers and provide the support for the individual programs outlined in this Strategy Document. The four relevant points are:

1. Provision of technical and information assistance programs;

2. Assistance to States to develop direct technical assistance programs;

3. On-going broad R&D projects; and

4. Develop a waste minimization information system.

The conclusion of the Report to Congress stated:

> Incentives for waste minimization are already strong, so EPA must capitalize on them. Most lacking is access by generators to the information that will demonstrate the economic benefits of waste minimization to industry, overcome logistical problems, and help develop creative new approaches. This can be provided by a strong technical assistance and information transfer effort, which can achieve through voluntary means what would be inefficient and possibly counterproductive to attempt through regulation.

The individual programs outlined in this Strategy Document are intended to expand the Agency's current hazardous waste minimization activities to provide the means for furthering waste minimization. While this Strategy addresses just hazardous wastes as opposed to all wastes, it is felt that there will be substantial spill-over effects on the reduction of air and water pollution discharges as well.

The goals of this Strategy are to:

1. Promote a national waste minimization policy;

2. Convert into action the goals and policies of the EPA Report to Congress; and

3. Provide a technical foundation for furthering the acceptance of technologies that reduce hazardous waste generation.

The Proposed Program

The Strategy encompasses five individual programs.

1. Waste Reduction Innovative Technology Evaluations (WRITE) Program

   A major program in the Strategy to evaluate and/or demonstrate good ideas, processes, and technologies that achieve hazardous waste minimization. Projects are to be carried out at the facilities of large and small businesses. Some cost sharing with small businesses may be appropriate.

2. Waste Reduction Evaluations at Federal Sites (WREAFS)

   A series of evaluation and demonstration projects for waste reduction conducted cooperatively by the EPA and various parts of the DOD, DOE, and other Federal Agencies.

3. Waste Reduction Audit Protocols (WRAP) Program

   A program to develop and test in actual manufacturing facilities, waste reduction assessment procedures suitable for identifying potential waste reduction opportunities. An individual subprogram will be developed for each of the major hazardous waste generating sectors.

4. Waste Reduction Research Support (WRRS) Program

   A program with the Illinois Institute of Technology to expand their long-term research on the development of process changes and substitute feedstocks that will enhance waste management possibilities, and a program with Tufts Center for Environmental Management to evaluate market and regulatory mechanisms that affect waste minimization.

5. Waste Reduction Technical Assistance Program (WRTAP)

   A contractor-supported in-house activity to coordinate and encourage the dissemination of information on waste minimization that results from the EPA programs, state programs, and other organizations that generate relevant information. Included in this program area is the development and maintenance of an easily accessible data bank for waste minimization techniques.

Waste Reduction Innovative Technology Evaluations (WRITE) Program

Reducing the generation of hazardous wastes can be achieved in many ways. Process chemistry can be changed; potential waste streams can be recycled within a manufacturing process or back into the process; process technology and/or equipment can be modified to produce products more efficiently, resulting in less waste; plant operations, i.e., "housekeeping" methods, can be changed or controlled to produce fewer and smaller waste streams or less waste in general; changes in raw materials (feedstocks) can lead to fewer waste streams or less-hazardous waste streams; finally, changes in the end products from manufacturing operations can, in some instances, be made so as to affect the types and quantities of wastes emitted. The early introduction of these and other waste reduction techniques into broad commercial practice is the objective of the WRITE Program.

The WRITE Program is a program to involve the EPA with private industry to encourage the development and/or demonstration of effective techniques and technology for hazardous waste minimization. The program has two subprograms--one, a program designed to allow the Agency to work with large industries, and the other designed to allow the Agency to work with small industries and State waste minimization programs, SB-WRITE. While both subprograms involve the evaluation or demonstration of waste minimizing technology, only the SB-WRITE Program involves the awarding of any funds to the industrial firms involved. The program for large businesses is based more upon the model currently being used in the Agency's Superfund Innovation Technology Evaluation (SITE) Program, i.e., the EPA generally provides funds to support only the evaluation of the demonstration and the generator assumes the costs of carrying out the demonstration. The SB-WRITE Program would be supported through cooperative agreements with State agencies.

Typical large projects might come through contacts with industry associations, state governments, professional associations, or public solicitations. The EPA's contributing support for evaluation expenses would depend upon the project's having a wide applicability and a high chance of success or upon its innovativeness. It is envisioned that EPA support would average on the order of $250K per project. Efforts would be made to maintain active projects in all of the major waste generating industry sectors.

A typical SB-WRITE project might consist of the demonstration of a new source reduction technique at a small business, such as an electroplating shop. The state agency would be responsible for the project award and monitoring. An average of perhaps $25K per project would be provided. It is envisioned that this amount would be leveraged considerably by the involved state and the company. Some percentage of matching contributions would be a requirement for the program.

The WRITE program is based upon the Agency's perception that a significant disincentive to the acceptance of new processes is the lack of credible technical information on the processes. The Report to Congress states, "Finally the most significant technical barrier to waste minimization may often be a lack of suitable information on source reduction and recycling techniques." The 100 or so projects that will result from this program will contribute to lowering this barrier in several ways. First, the reports on

the projects will be aggressively marketed in the technical and industrial communities through the WRTAP and similar technology transfer programs throughout the country. Second, the projects will be designed as demonstration projects which can be viewed as they are operating. This has proven to be an effective means of facilitating new process adoption. Finally, the Agency's active support of the WRITE Program will illustrate the degree of commitment of the EPA to encourage waste minimization. Historically, such an Agency commitment has had a significant multiplier effect on encouraging environmental improvement programs and has served to accelerate the development of more environmentally-acceptable products and processes.

The incentives for industrial participation are perceived to be: (1) their interest in getting partial government subsidization for a waste minimization project which, if they don't, one of their competitors might propose; (2) their interest in both public and Agency "good will" by participating in a publicized joint effort with the EPA to actually eliminate an environmental or health hazard before it is created; (3) their interest in having EPA work directly with them on a new waste minimization concept which they hope will ultimately meet the RCRA manifest waste minimization requirements; or (4) their interest in obtaining EPA's assistance in the evaluative procedures and protocols associated with a novel waste minimization technique. Also, Agency participation in a technology project would provide a considerable credibility to any related delisting applications that might result.

One of the necessary ingredients in a successful waste minimization development or demonstration project is the ability to measure the actual reductions of hazardous wastes achieved. As the recent OTA report, Serious Reduction of Hazardous Waste, states, "The best way to measure waste reduction is to determine the changes in the absolute amounts of hazardous components." For this purpose, various new or improved analytical methods will be required--methods that can work in process streams and in individual process waste streams. Not all of the methods needed are available or able to perform with adequate quality assurance. Therefore, some effort under this program will have to be devoted to a methods development research activity specifically aimed at supporting the needs of this program. Another necessary ingredient is the ability to conduct specific R&D projects aimed at providing data which would allow highly promising waste minimization concepts to be explored.

It is planned that certain priority wastes or industries will be identified as areas of emphasis in project selection. Input to emphasis area identification will be provided by the various state minimization programs and the Headquarters and Regional Offices of the EPA.

Waste Reduction Evaluations at Federal Sites (WREAFS)

The various services within the Department of Defense are among the more active organizations currently pursuing waste minimization as a broad management strategy. Other Federal agencies are, of course, also involved in waste minimization. The manufacturing facilities operated by these agencies are not unlike manufacturing facilities operated by the private sector. Thus, there is significant potential for transfer of technology from Federal sites to industrial organizations employing the same manufacturing operations.

WREAFS will provide a low-cost structure for involving the EPA in a wide variety of projects already being funded by other Federal agencies. EPA will play the role of information broker and/or advisor for other agencies on project selection, evaluation methodologies and assessment of potential environmental benefits. EPA cost for this program will, essentially, be limited to staff time applied and necessary travel plus a small amount of contractor support to reduce EPA's staff time.

Waste Reduction Audit Protocols (WRAP) Program

The HWERL is presently supporting a small program to develop and evaluate waste minimization audits as tools for identifying opportunities for reducing waste generation. This program produces reports on the applicability of various auditing protocols for specific types of manufacturing facilities and waste streams. To date, this activity has proven very useful, not only as a means of developing the engineering and technical protocols required, but also as a means of identifying, during the testing of the protocols in prototype demonstrations, actual waste reduction opportunities which can be pursued by the companies cooperating in these studies. Under this strategy, this program will be accelerated and expanded to incorporate more types of waste-generating processes and more generic waste streams.

It is envisioned that subprograms will be developed for the WRAP Program to reflect the differences among industries and that the results of these subprograms will be the major subjects of a series of waste minimization industry-specific seminars carried out in cooperation with various industry and professional associations for the various industries.

Waste Reduction Research Support (WRRS) Program

The EPA Report to Congress emphasized that the movement of the country from dependence on land disposal and to some degree, treatment, would be a long-term proposition. It is believed that there is certainly a need for a program to provide support for research and development related to generic processes that might contribute to improving the state-of-the-art of waste minimization technology. There is also a need to introduce into the academic community an increased awareness of the potential of waste minimization as a preferable environmental improvement strategy. Two EPA Centers of Excellence already exist which relate directly to waste minimization--the Industrial Waste Elimination Research Center (IWERC) at IIT and the Center for Environmental Management (CEM) at Tufts University. It is proposed to work with these two Centers to develop appropriate applied waste minimization research activities. An important part of the WRRS Program will be the establishment of a network of individuals on the faculties of many universities to act as facilitators of ideas to enhance students' appreciation of waste minimization. The WRRS Program will also be used to work with other parts of ORD to solicit waste minimization research projects from the Small Business Innovative Research Program and to encourage the appointment of scientists and engineers with waste minimization interests under the EPA's Distinguished Visiting Scientists Program.

Waste Reduction Technical Assistance Program (WRTAP)

Accelerated information transfer to the "user community" on waste minimization is a critical requirement of the Strategy. Currently, although there are some excellent technology transfer programs supported by a few of the states, there is a need for a federal program to enable these states and others to better utilize the results of existing and proposed waste minimization activities.

The WRTAP will serve to facilitate and coordinate this information transfer process. Various mechanisms will be utilized including brochures, handbooks, project summaries, seminars, short courses, training cassettes, etc. Information on successful waste minimization methods and, to a degree, on those which have not worked as well as expected, will be made available. It is anticipated that close working relationships with appropriate trade associations and State agencies will be developed to aid in getting the waste minimization message to the industrial audience. A significant output of WRTAP will be the establishment and maintenance of a network of individuals active in areas related to waste minimization.

In addition to the need for transfer of information to and among industrial users, EPA Regional Offices and State regulatory officials will need guidance concerning what waste minimization techniques are practicable. In this area, WRTAP will coordinate the handling of requests for such information and would be able to call upon the capabilities of the various parts of the EPA as needed.

The WRTAP will include the development of an on-line computer-supported information system which will be easily accessible by the States, Regional Offices, universities, industry and others involved with waste minimization, and which can be constantly updated. This system is called for specifically in the EPA Report to Congress.

Waste minimization technologies, or low and non-waste technologies as they are more often called in Europe, are of interest to industrial countries throughout the world. Consequently, there is appreciable international activity going on that would be of interest to individuals and organizations in the U.S. Some part of the WRTAP will be devoted to establishing and nurturing an international network of individuals active in the waste minimization field.

Waste Reduction Institute for Senior Executives

An important part of the Agency's proposed waste minimization strategy to reduce technical barriers to the furtherance of waste minimization is the establishment of an Institute of some 25 senior engineers and scientists with experience in the various waste generating industries. It is expected that many of the Institute members will be retired from distinguished careers in industry. The overall purpose of the group, which will be supported through a cooperative agreement with a yet-to-be-determined appropriate

professional association (AAEE, AIChE, ASME, etc.), will be to assist the Agency in carrying out the various parts of the program. It is envisioned that such assistance might take the form of reviewing and commenting on individual project proposals, participating as lecturers in WRTAP seminars, participating in the WRAP program as technical experts and providing general advice and support to the in-house staff.

The members of the institute might also be charged with carrying out an independent program to encourage the adoption of waste minimization concepts through a variety of mechanisms. These mechanisms would include, for example, the production of brochures, handbooks, etc., describing successful waste minimization techniques which have been used, perhaps only once by one company at one location, but which have never been recorded in the literature or publicized in any way. The mechanisms could include a speakers bureau which could direct qualified "waste minimization evangelists" to various industries and to trade association and technical society meetings to spread the word on this subject. The mechanisms could involve assistance to universities in modifying their plant design and process design courses so that students would be trained from the beginning to consider and evaluate alternative designs which minimize waste generation. This new emphasis on the training of our "next generation" of design engineers would help to eliminate future hazardous waste problems from the production and use of chemicals now unknown. There are, clearly, many, many more functions such a group could perform. ORD has been favorably impressed by the positive reaction of several individuals in the industrial community to this idea.

IMPLEMENTATION PLAN

Presented below are two options for implementing the strategy. Option A is for the full amount requested beginning with $3.9 million in FY88. Option B involves modest initiation of the plan beginning with only $.9 million in FY88. Both options total $12.8 million for 3 years.

Report to Congress

Minimization of Hazardous Waste

Executive Summary
and
Fact Sheet

October 1986

Report to Congress

MINIMIZATION OF HAZARDOUS WASTE

Summary of Recommendations

The Environmental Protection Agency has concluded that mandatory standards of performance and required management practices are not feasible or desirable at this time. The Agency recommends that the effect on waste minimization of the land disposal restrictions and other HSWA mandates, as well as amendments to CERCLA, be quantified and analyzed. EPA will report back to Congress on this determination in December 1990, the earliest date at which it believes a recommendation on the need for a major waste minimization regulatory program could be made. Until that time, however, EPA recommends a three point waste minimization strategy:

Information Gathering

Continuing collection of information on waste stream volume and composition, generation rates by various types and sizes of generators, adequacy of capacity for TSD facilities, and the cumulative effect of HSWA requirements on voluntary waste minimization practices.

Core Waste Minimization Program

- Development and publication of informal guidance on waste minimization for the purpose of the reporting and certification requirements of HSWA Sections 3002 and 3005.
- Provision of a technical and information assistance program to generators and to States to aid in the development of waste minimization programs.
- Assistance to specific States to develop programs for providing direct technical assistance to generators (e.g., using waste audits, dissemination of technical information, applied research on new applications of existing technology).
- Highlight ongoing research and development and economic feasibility studies that might serve an entire region or have regional application.
- Development of an information system on waste minimization, accessible by the States.
- Implementation of mandatory controls, as needed, for controlling the generation of wastes for specific industries or processes using current authority under TSCA Section 6.
- Incorporation of waste minimization into the review of TSCA Premanufacture Notices.

Longer Term Options

After evaluation of information gathered in the short term, EPA may better assess in its 1990 report to Congress that additional authority to adopt mandatory standards of performance or management practices as a means of reducing wastes would be warranted.

In the interim, EPA will continue to examine the specific elements of the "core" waste minimization program and consider the need for longer term options, if needed. As part of the next RCRA reauthorization, EPA will provide Congress with its most current assessment of the need to modify the existing waste minimization requirements for generators and TSDFs. Among the possible options to consider would be:

- To prohibit, where appropriate, certification of certain types of waste management practices as waste minimization.
- To specify what may be certified as waste minimization.
- To define necessary documentation for certifications that state that waste minimization is not economically practicable.

APPENDIX C

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RESEARCH AND DEVELOPMENT
HAZARDOUS WASTE ENGINEERING RESEARCH LABORATORY
CINCINNATI, OHIO 45268

MEMORANDUM

DATE: April 24, 1987

SUBJECT: Request for SAB review of Waste Minimization Strategy

FROM: Thomas R. Hauser
Director, Hazardous Waste
Engineering Research Laboratory

TO: Eric Males
Executive Secretary, Environmental
Engineering Committee, SAB (A-101F)

Since our briefing of the SAB on the subject of waste minimization on March 5 in Washington, we have prepared a more complete strategy document (copy attached) outlining specific programs we would like to undertake. During the intervening time we have made presentations before senior ORD and OSWER officials and before the Administrator. The proposed strategy appears to have been well received and we have been encouraged to continue to pursue the implementation of a waste minimization program. We have also convened a two-day workshop on the subject of waste minimization that was attended by some 70 individuals from various public and private organizations. These workshop participants provided many useful comments on the proposed strategy and its programs.

We feel we are now at a stage where a further review of the proposed strategy by the SAB would be very useful. The Board's responses to the specific questions attached would be especially useful to us. Of course, we are also interested in any general comments on the subject which Board members may have.

We would appreciate having the benefit of the Board's review and look forward to hearing from you as to whether and when this could be done.

Attachment

Questions Regarding Proposed Waste Minimization Strategy

1. There is some disagreement between the EPA and others over whether the focus of the program should be only on "waste reduction" (defined generally as waste elimination through in-process changes) or on "waste minimization" (generally defined as any reduction of wastes going to disposal whether through source reduction, through on-site or off-site recycling or even through treatment of wastes to reduce volume, mass or toxicity). The former definition is narrower and excludes such things as off-site recycling and almost all processes that might be seen as treatment. Your thoughts?

2. Any program must start somewhere. We would appreciate your thoughts on which specific waste streams and/or industrial sectors should receive initial priority. In the same light, should the program emphasise small, mid-size or large generators?

3. The WRITE Program is aimed at evaluating and documenting successful waste minimization techniques. Any experiences you may have had with similar evaluations/demonstration would be helpful. For instance, have you found such programs to be effective as a means of encouraging use of improved technology by industry? How does one overcome the inherent reluctance of one company to disclose successful methods to its competitors?

4. The Waste Reduction Research Support (WRRS) program is intended to provide a means of supporting long-term research. At present, it is probably the least defined of the five proposed activities. Two questions: 1) how do you think we should structure this program to encourage creative, useful research and 2) what areas of research do you think would be especially fruitful?

5. Many people, including yourselves, have told us efforts should be made to somehow impact university engineering curricula to raise the consciousness of new graduates concerning waste minimization. First, how can this best be done and second, where do you see such an effort fitting in the strategy as outlined?

6. Any comments about the appropriateness of the proposed allocation of resources?

7. What types of data would be most useful as outputs from the projects to be supported by the WRITE program? Do you think it would be useful to run WRITE projects as demonstrations open to the public?

8. Should only "innovative methods" be supported under the WRITE and Sb WRITE Programs? The case has been made that we already have much of the needed technology for waste minimization and that what is most needed is to get generators to use such technology even if it's not "innovative". Your observations would be helpful as to the "balance" the WRITE Program should have in attempting to catalyze waste reduction acceptance by industry whether "innovative" or not versus a focus only on innovative methods.

9. Are there any significant areas that are not addressed by the strategy given that the purpose of the strategy is to help overcome "technical barriers" (as opposed to "economic" or "regulatory barriers") that would inhibit the acceptance of waste minimization by industry.

10. There is a concern that the EPA or State regulatory agencies, regardless of their good intentions, will have difficulty arranging cooperative projects with industrial generators who might be afraid of enforcement hassles. First, from your experience how much of a problem will this be? Second, how can we address this situation?

11. Does the Waste Reduction Institute for Senior Executives strike you as a worthwhile undertaking? What organization (e.g., technical society, the NAS/NAE, etc.) would be the best "home" for the Institute? How should members be recruited?

U. S. ENVIRONMENTAL PROTECTION AGENCY
Science Advisory Board
Environmental Engineering Committee

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APPENDIX E

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