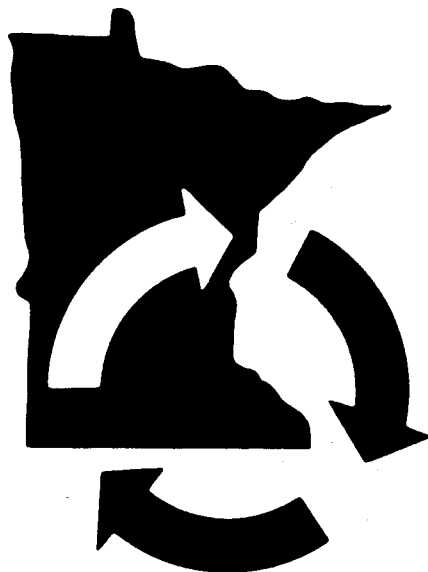


REPORT ON BARRIERS TO POLLUTION PREVENTION



Prepared By

The Minnesota Office of Waste Management

March, 1991

POLLUTION PREVENTION *Right From The Start*

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EXECUTIVE SUMMARY

A. INTRODUCTION

The Minnesota Toxic Pollution Prevention Act (TPPA), Minnesota Statutes § 115D, was signed into law on May 3, 1990. The TPPA establishes a new emphasis in environmental policy within the state of Minnesota. This new emphasis focuses on preventing pollution at the source in ways which minimize the transfer of toxic pollutants from one environmental medium to another.

Several programs to encourage pollution prevention in the state are mandated by the TPPA. These programs include:

- ▶ Pollution prevention assistance;
- ▶ Financial assistance for research and development;
- ▶ Governor's awards for excellence in pollution prevention;
- ▶ Required pollution prevention plans and annual progress reports from industry;
- ▶ Fees based on toxic chemicals released and hazardous waste generated; and
- ▶ Reports to the Legislature.

The TPPA also requires the Office of Waste Management (OWM) to prepare a report on barriers to pollution prevention in Minnesota. Specifically, the OWM is directed to:

"...prepare and submit a report to the environment and natural resources committees of the legislature analyzing the barriers to pollution prevention. At a minimum, the director shall report on regulatory, economic, educational, and institutional barriers and shall recommend strategies to overcome these barriers. Further, the report shall describe ways in which government may serve as a role model in pollution prevention."

This Report on Barriers to Pollution Prevention is in response to this legislative requirement.

1. DEFINING POLLUTION PREVENTION

Minnesota Statutes § 115D.02, subdivision 8 defines pollution prevention as "eliminating or reducing at the source the use, generation, or release of toxic pollutants, hazardous substances, and hazardous wastes." The key phrase in this definition is at the source. Pollution prevention involves taking measures to address pollution at its source of generation, eliminating toxic pollutants before they are created. By preventing pollution, a waste or emission is not generated in the first place.

Pollution prevention approaches range from simple methods and techniques to advanced technologies. Simple preventive applications may include such things as covering exposed containers of volatile chemicals or tightening loose and leaking pipe connections (i.e., good housekeeping). Other low-tech options include personnel training, improved business operations and inventory control practices. More sophisticated or

comprehensive pollution prevention applications include substituting raw materials (e.g. switching hazardous organic-based solvents to water-based or aqueous materials), redesigning manufacturing processes, increasing the efficiency of production, or redesigning and reformulating products.

Pollution prevention is an environmental approach fundamentally different from approaches that focus on managing or controlling pollution after it has been generated. Stopping pollution before it is generated, rather than trying to manage, control or clean it up afterwards, is the idea behind pollution prevention. Pollution prevention occurs prior to the creation of a waste or a pollutant and thus occurs prior to the consideration of alternatives such as pollution control, waste management, treatment, recycling or disposal.

The health care field provides a useful analogy in distinguishing pollution prevention from other environmental strategies such as pollution control, treatment, or disposal. "Preventive medicine" focuses on behavioral and lifestyle choices such as diet, exercise, and other factors within control of the individual that help to prevent disease. If illness is contracted, approaches such as medication or surgery must be used to cure or address medical problems. Such approaches often cost more and involve higher risks and greater potential for side effects than preventive approaches.

The overall health of a society requires aggressive attention to both approaches. This is analogous to the situation in environmental protection in which preventive approaches are preferable to control, treatment, or disposal of pollutants. However, the key to a healthy environment is a comprehensive set of approaches used to address a wide range of situations.

2. MINNESOTA'S ENVIRONMENTAL CHALLENGES

The TPPA is a key element of Minnesota's strategy to address the environmental challenges facing the state. Each year, Minnesota businesses generate over 100,000 tons of hazardous wastes that ultimately must be treated, incinerated or landfilled. Minnesota's Capacity Assurance Plan calls for achieving a 40 percent reduction rate in the generation of hazardous wastes by the year 2009. With landfill capacity quickly dwindling, and given the great difficulties involved in siting new facilities, it is imperative that government, industry and the public work together to meet this goal.

In calendar year 1989, manufacturing plants alone reported that toxic chemical releases totaling over 80 million pounds were released to Minnesota's air, water and land. This data, reported under the Emergency Planning and Community Right-to-Know Act, shocked industry, government and the public. Pollution prevention represents a key strategy for reducing these releases.

Industry and government are learning that we cannot continue to rely solely on "end-of-pipe" actions such as pollution control and waste management to protect our environment. By managing or controlling problems after they have been created, we run the risk of only partially addressing them, and later finding that our approaches have

unintentionally become sources of other problems. One example is the use of scrubber and baghouse systems to capture air pollutants. These systems generate solids containing toxics which then must be disposed of on land.

3. BENEFITS OF POLLUTION PREVENTION

The most obvious benefit of pollution prevention is a cleaner environment. But pollution prevention does more than protect the environment: it also makes good economic sense. Pollution prevention is significant because in many instances it is a cost-effective approach which can pay dividends to companies instituting such practices. Sharply escalating waste disposal and clean-up costs can be avoided by not generating wastes in the first place. Long-term "cradle-to-grave" liabilities linked with hazardous wastes and ever-increasing pressures to comply with stringent environmental regulations can be decreased if opportunities are seized to prevent wastes. By improving operations, businesses are finding that expensive raw materials and energy are conserved through pollution prevention. Pollution prevention presents a "win-win" situation in which both the company and the environment benefit. Pollution prevention holds the promise of substantially reducing toxic chemicals in our environment and linking these efforts with environmentally sustainable manufacturing and economic development. Additionally, pollution prevention can create positive community relations as neighbors see that companies are being proactive by preventing pollution from being generated.

4. PREMISE AND OVERVIEW OF REPORT CONTENT

This report recognizes that there is great potential for progress in preventing pollution in Minnesota. It is the premise of this report that Minnesota is not taking advantage of opportunities to prevent pollution because of unnecessary regulatory, economic, educational, and institutional barriers. The purpose of the report is to identify barriers to pollution prevention and to recommend strategies for overcoming them.

The report consists of chapters addressing specific areas in which barriers to pollution prevention may exist. Chapters are divided in accordance with the statutory language mandating this report: regulatory, economic, educational, and institutional. A final chapter describes ways in which government can serve as a role model in pollution prevention.

B. REGULATORY BARRIERS TO POLLUTION PREVENTION

1. SUMMARY OF BARRIERS

The current environmental regulatory system emphasizes control, treatment or appropriate containment of pollutants rather than prevention at the source. The widespread use of air pollution control and wastewater treatment equipment and land disposal facilities demonstrates the reliance on these "end-of-pipe" measures. The relationship between the current regulatory system and pollution prevention is complex. In many instances, the enforcement of existing regulations can create a powerful incentive for pollution prevention. In addition, pollution prevention approaches are

increasingly being integrated into the regulatory framework. However, barriers still exist to the full implementation of pollution prevention. Issues addressed in this chapter include:

- ▶ **End-of-Pipe Focus.** In most instances, the end-of-pipe focus of existing regulations does not create a direct barrier to pollution prevention. However, there is a potential negative effect of focusing industrial and public resources on controlling pollutants after they have been created rather than on product, process, or raw material changes.
- ▶ **Media-Specific Focus.** Current regulations address one environmental medium at a time. The result can be transfer of pollutants from one environmental medium to another and concentration on media-specific solutions rather than multi-media preventive approaches. Media-specific focus does not always encourage multi-media preventive approaches.
- ▶ **Regulatory Program Evaluation Criteria.** Current benchmarks for measuring the success of programs do not include consideration of pollution prevention progress. The focus is on more easily quantified performance measures such as the number of permits issued or the number of inspections performed. There is pressure to allocate resources based on increasing reported benchmarks rather than on activities directly related to pollution prevention.
- ▶ **Regulatory Inflexibility.** A lack of flexibility can sometimes create a barrier to pollution prevention. Pollution prevention is a customized process, varying facility by facility. At times, this may require flexibility and short-term variances in compliance schedules for emission standards or permits.
- ▶ **Regulatory Uncertainty.** Industry personnel working to implement pollution prevention strategies may be required to consult with several agencies with decision-making authority. An innovative project or a pollution prevention proposal may require multiple approvals for different aspects of that project, which may be difficult to obtain. This can discourage facilities from undertaking pollution prevention practices.
- ▶ **Pollution Fees.** If structured on a multi-media basis with a significant correlation to quantities of pollutants created and set at sufficient levels, fees can provide incentives for pollution prevention. Current fees are for the most part media-specific, set at levels determined by the costs of regulatory services, and in some cases are not closely correlated with quantities of pollutants released. Although fees set up in this manner do not present direct barriers to pollution prevention, they provide little incentive to go beyond standards and prevent pollution at the source.
- ▶ **Data Gathering and Management.** Data gathering and management systems have generally developed along media-specific lines. They focus on end-of-pipe emissions and quantities of waste generated as a means of enforcing and ensuring

compliance with existing regulatory requirements. The need for improved data relating to pollution prevention is recognized at both the federal and state levels.

2. RECOMMENDATIONS

Recommendations regarding regulatory barriers are presented and explained in detail in Chapter II.

► **Continue to Integrate Pollution Prevention into the Regulatory System.**

MPCA activities should include integrating pollution prevention into all regulatory programs, establishing program goals relating to the achievement of pollution prevention objectives, evaluating the need for flexibility in existing regulations, addressing pollution prevention in rulemaking, and pursuing multi-media permitting and enforcement activities where appropriate. MPCA should also study ways to best expand and coordinate data and consider changes to fees to provide greater incentives to prevent pollution.

► **Report Progress in Implementing Prevention in MPCA Biennial Reports.**

MPCA's biennial reports to the legislature (Minnesota Statutes § 116.10) should include statements of progress made in the implementation of pollution prevention and identify pollution prevention strategies as one component in its long-range plan.

► **Adopt Recommendations to Expand Toxic Chemical Release Inventory.**

The Legislature should adopt the recommendations outlined in the Minnesota Emergency Response Commission's (ERC) report regarding the expansion of Toxic Chemical Release Inventory (TRI) reporting in Minnesota.

► **Amend Act to Require All Reporting Facilities to Plan.**

The Legislature should amend the Minnesota Toxic Pollution Prevention Act to require all facilities reporting releases under Minnesota's TRI requirements to prepare pollution prevention plans and pay pollution prevention fees. Currently the planning requirement is linked to the federal law. This recommendation is contingent upon expanding the Toxic Chemical Release Inventory (see above recommendation) reporting requirement beyond federal requirements.

► **Affected Groups Should Take Steps to Improve Communication.**

Progress in preventing pollution depends in an important way on good communication and an atmosphere of partnership between affected parties. State agencies such as the OWM, MPCA, and ERC can play an important role in providing opportunities for non-confrontational communication between industry, citizen groups, the public, and government agencies. Industry can also be proactive by working with the public and with community groups throughout the toxic pollution prevention planning process and by understanding and responding to their concerns.

C. ECONOMIC BARRIERS TO POLLUTION PREVENTION

1. SUMMARY OF BARRIERS

Economic factors often work in favor of pollution prevention approaches. The benefits of such projects often include easily measurable factors such as greater operational and production efficiencies, increased product quality, reduced regulatory and waste management expenses, reduced long-term liabilities, and reduced raw material costs. Other benefits, such as increased employee morale or enhanced corporate reputation, are also important although more difficult to measure. Because of these benefits, pollution prevention is in many cases profitable. Facilities can achieve at least some direct return on their investment in contrast to pollution control approaches which typically only add to overall operational and production costs.

Although pollution prevention may be the best option for economic and environmental reasons, many companies nevertheless do not undertake pollution prevention programs. There is widespread belief that many pollution prevention opportunities are not being realized because of various barriers related to the way in which businesses make economic decisions.

- **Inaccurate Market Signals.** In some instances, the costs of releasing toxic substances may be less than the cost of implementing a pollution prevention project. This is often because the full environmental cost of the release is not included in the calculation.
- **Incomplete Cost/Benefit Analysis.** Indirect benefits (e.g., lower future liabilities, potential for "environmental marketing" and positive investment image) are not commonly considered in an analysis and therefore do not reflect the advantages of implementing preventive projects. Failure to take into consideration all relevant costs and benefits or failure to properly allocate these costs to appropriate operations and processes may present unnecessary barriers to pollution prevention.
- **Inappropriately Short Time Horizons.** Companies with very short-term perspectives on criteria for investment (e.g., 1-2 year payback periods) may be less

likely to support certain prevention projects despite the fact that they would be economically viable in a moderate payback timeframe.

- ▶ **Fear of Market Share Loss/Consumer Pressure.** Surveys suggest that the most significant barrier to pollution prevention is reluctance to tamper with proven processes for fear of adverse effects on product quality.
- ▶ **Inappropriate Product/Process Specifications.** Very specific cases involving the barrier, "fear of customer loss," result from unnecessarily rigid specifications for products or processes.
- ▶ **Fear of Production Interruption.** If prevention options require major operational changes, equipment alterations or process modifications, companies may resist implementation because of concern about not being able to produce the product at all or having higher reject rates through less reliable actions.
- ▶ **Limited Access To Necessary Resources.** Prevention projects can face stiff competition for limited internal capital resources. The shortage of staff resources also presents a significant barrier to pollution prevention. Access to external sources of capital to fund prevention projects may also be limited.
- ▶ **Worker Fear of Job Loss.** If employees or labor groups look upon pollution prevention as a threat to their jobs, these concerns may pose a barrier to pollution prevention efforts. Experience shows that companies with pollution prevention programs are often strengthened economically, and produce higher quality products in a more efficient manner.

2. RECOMMENDATIONS

Recommendations regarding economic barriers are presented and explained in detail in Chapter III.

- ▶ **OWM Should Explore Ways to Internalize External Costs to Assure Appropriate Market Signals.**

Options to be explored include front-end fees on hazardous chemicals and expansion of the existing pollution prevention fees.

- ▶ **The Legislature Should Remove the \$30,000 Cap on the Pollution Prevention Fee.**
- ▶ **OWM Should Expand Technical Assistance to Allow for an Increased Emphasis on Appropriate Economic Analysis in Assessing Pollution Prevention Options.**
- ▶ **OWM Should Work With Educational Institutions and Others to Expand the Training of Business Decision-Makers to Include Consideration of the Full Costs and Benefits of Environmental Decisions.**

- ▶ **OWM Should Continue To Evaluate the Effectiveness of its Financial Assistance Programs for Pollution Prevention.**
- ▶ **OWM Should Evaluate the Merits of Creating Pollution Prevention Programs Directed at Consumers.**
- ▶ **Businesses Should Institute Worker Retraining Programs in Instances Where Pollution Prevention Activities May Affect Workers.**
- ▶ **OWM, in Cooperation with Other State Agencies, Should Review Government Procurement Practices and Specifications to Promote Adoption of Pollution Prevention Practices.**

D. EDUCATIONAL BARRIERS TO POLLUTION PREVENTION

1. SUMMARY OF BARRIERS

Education for pollution prevention can occur in widely diverse settings and institutional contexts, including both formal educational institutions and informal on the job or in-service training opportunities. Minnesota businesses have identified lack of information and inadequate educational training of new employees as a barrier to pollution prevention. Despite the increasing importance of environmental issues in finance, marketing, operations, and strategic management, business schools devote minimal attention to the interaction of business and the environment.

Both industry and academia recognize inadequacies in information transfer and education which prevent effective utilization of pollution prevention in environmental management. There is also wide-spread consensus that integration of pollution prevention into business as usual will require, among other things, increased education, public support, and information transfer. The following barriers are identified in this chapter:

- ▶ **Lack of Top Level Support.** It is common for educational leaders to simply exclude pollution prevention and environmental protection from institutional priorities.
- ▶ **Insufficient Faculty Motivation and Training.** This barrier is caused, in part, by the difficulty in creating new courses, unavailability of teaching aids (e.g., case studies), lack of faculty knowledge on preventive applications, and research pressures.
- ▶ **Insufficient Student Interest.** Student demand for treatment of environmental issues has been small, possibly because they haven't yet seen a connection between job success and environmental expertise.
- ▶ **Inflexible Curriculum Requirements.** At most educational institutions the degree coursework is already crowded with requirements and continually faces

new demands to add more credits and topics. In many instances, there is simply little or no room to add pollution prevention into the program.

► **Lack of Instructional Materials.** Many faculty lack the preparation to teach in the area of pollution prevention and environmental protection. There is not sufficient existing material (e.g., casebooks, text books or videos) that is easily available to integrate into existing classes.

2. RECOMMENDATIONS

Recommendations regarding educational barriers are presented and explained in detail in Chapter IV.

► **Educational Institutions Should Provide Strong Top-Level Support for Pollution Prevention Education.**

► **Educational Institutions Should Act as Role Models by Adopting Pollution Prevention Programs.**

► **Educational Institutions Should Modify Curricular Structures and Requirements as Appropriate to Encourage Pollution Prevention Education.**

► **Educational Institutions Should Promote Environmental Literacy by Infusing Environmental Concepts Throughout Lower Level Required Courses.**

► **Educational Institutions Should Offer Cross-Disciplinary Programs that Address the Needs of Pollution Prevention Specialists.**

► **Educational Institutions Should Offer Specialized Courses that Address Pollution Prevention, Among Other Topics in Environmental Protection.**

► **Educational Institutions, Industry, and Government Should Fund the Development of Curricular Materials.**

► **Special Teaching Tools Should be Developed and Utilized as Appropriate.**

Case studies, field trips, guest lecturers and internships are needed and efforts should be made to utilize these teaching tools.

► **Facilitate Staff Development and Research.**

Educational institutions, state government, and industry should cooperate in offering training for instructors in teaching pollution prevention. Faculty members should be supported in their efforts to gain grants for pollution prevention. Faculty awareness and concern must precede that of students.

► **Promote Partnerships Between Academic Institution and Others.**

Government should encourage collaboration between industry and educational institutions in creating, modifying, or delivering courses. Educational institutions should establish industry advisory boards to express need and to guide and develop curriculum for appropriate subject areas. Industry should more actively communicate its need for environmental and pollution prevention professionals.

► **Special Potential for Continuing Education Courses for Industry Staff Should be Explored and Developed.**

► **Leverage National Efforts.**

Educational institutions, industry, and government in Minnesota should support a national forum on pollution prevention education. Minnesota should work to influence pollution prevention education through accreditation boards.

E. INSTITUTIONAL BARRIERS TO POLLUTION PREVENTION

1. SUMMARY OF BARRIERS

Rules, behavior patterns, prescribed practices, and adherence to established forms are common ideas associated with institutions. These characteristics used to define institutions are the focus of this chapter. The term institution is used to tie together a suite of barriers to pollution prevention. These barriers involve habits and inertia that individuals experience at work while using equipment or technologies, or performing routine operations. Also included within this category of barriers are societal beliefs that impact the work environment.

Three categories of institutional barriers are addressed in this chapter:

- Organizational;
- Technical; and
- Societal.

Organizational barriers reflect the ways in which companies manage human and material resources. Technical barriers address the development and use of technologies and operational practices. Societal barriers describe some ways in which society impacts pollution prevention efforts.

The following specific institutional barriers are addressed in this chapter:

- **Lack of Top Management Support.**
- **Lack of Clear Communication of Priorities or Support.**

- ▶ **Organizational Structures May Separate Environmental Decisions From Production Decisions.**
- ▶ **Habit and Inertia May Inhibit Change.**
- ▶ **Lack of Involvement of Affected Workers.**
- ▶ **Reward System Does Not Focus on Pollution Prevention.**
- ▶ **Firms May Lack the Technical Ability to Apply Preventive Methods and Technologies.**
- ▶ **Frequent Changes to Output, Product Design and Other Factors May Make Implementation More Difficult.**
- ▶ **Lack of Information about Sources of Waste and Releases, Alternative Strategies, and Resources.**
- ▶ **Preventive Applications Not Currently Available.**
- ▶ **Perception That Pollution Prevention Addresses Only Manufacturing Processes.**
- ▶ **Lack of Consumer Environmental Awareness.**

2. RECOMMENDATIONS

Recommendations regarding institutional barriers are presented and explained in detail in Chapter V.

- ▶ **Continue and Expand Technical Assistance.**

It is widely recognized that government-sponsored technical assistance and information exchange is critical to overcoming institutional barriers (e.g. technical) to pollution prevention. This successful approach should be continued and expanded.

- ▶ **Support and Expand Toxic Chemical Reporting Requirements.**

Support should continue for efforts to provide community right-to-know data to the public and to involve communities in environmental protection. This recommendation includes expanding the toxic chemical reporting requirements to other industry groups. Further, initiatives that encourage industry to self-evaluate and implement prevention projects should be supported.

- ▶ **Support Technology Transfer Via Non-Government Entities.**

OWM should solicit support for information transfer via non-governmental organizations such as business groups, chambers of commerce, trade associations, industrial suppliers, and equipment vendors.

- ▶ **Industry Should Reform Policy and Practices to Eliminate Organizational and Technical Barriers.**

Industry should build prevention into its culture through top leadership support and formal programs. Businesses should involve employees in

prevention efforts. Also, industry should institute employee incentive/bonus programs and train employees who work with hazardous materials. Where feasible, companies should reform practices to eliminate technological barriers.

► **Encourage Public Education in Pollution Prevention.**

F. GOVERNMENT AS A ROLE MODEL

1. SUMMARY OF ANALYSIS

An examination of government as a role model is consistent with increased recognition over the past several years that government can affect policies and practices not only through legislation, but also by its own actions. This opportunity is clearly present in the area of pollution prevention.

Government activities at various levels generate wastes and release a wide variety of toxic chemicals into the environment. Although data on government use and release of toxic chemicals is fragmented, some facilities are regulated as large quantity hazardous waste generators (generating more than 1,000 kilograms per month). Further, it is likely that toxic chemical wastes are directly released to air, water and land resources.

As both a regulator and waste generator, government has a tremendous opportunity to lead in development and adoption of pollution prevention programs. Institution of government-wide pollution prevention programs stands to benefit many constituencies. Citizens benefit from a cleaner environment and industry benefits from the resultant technology transfer. Participating agencies and departments benefit from reduced liabilities associated with hazardous wastes and reduced disposal and treatment costs. In addition, participating departments save expensive raw materials, comply with existing environmental regulations, improve the image of government, and reduce employee exposure to hazardous materials.

Government can increase its credibility with industry by instituting pollution prevention programs. Industry's voice has been prominent in the call for government to serve as a model of pollution prevention. It makes good economic sense for government to act as a role model in pollution prevention. Reducing wastes, hazardous chemical use, and toxic chemical releases saves money and promotes efficiency. Especially in an era of government fiscal austerity measures, pollution prevention should be viewed as a key element of a strategy to reduce costs and invest for the future.

2. RECOMMENDATIONS

► **The Governor Should Issue an Executive Order to Agency and Department Heads Requiring an Examination of Operations and the Institution of Pollution Prevention Programs.**

- ▶ **OWM Should Undertake an Analysis of Toxic Chemical Releases From Government Facilities and Current Pollution Prevention Efforts at These Facilities.**
- ▶ **OWM Should Initiate a Pilot Project in Pollution Prevention Targeted at a Selected Number of Governmental Facilities.**
- ▶ **Toxic Chemical Reporting Requirements Should be Expanded to Include Government Facilities Recommended in the Minnesota Emergency Response Commission's Report to the Legislature.**

G. CONCLUSION

Minnesota's vision is to develop an integrated approach to preventing pollution at its source. The vision must be supported and implemented by all sectors of society, including industry, the public, government, and educational institutions, if it is to be realized. Further, pollution prevention as an environmental strategy is applicable not just to industry, but to a broad range of societal activities (e.g., energy, agriculture and transportation issues). Aggressive implementation of pollution prevention offers great opportunities for enhanced environmental protection and increased industry efficiency and economic health. Achieving this vision will require an understanding and elimination of barriers to pollution prevention.

I. INTRODUCTION

A. LEGISLATIVE CONTEXT AND OVERVIEW OF REPORT

1. THE MINNESOTA TOXIC POLLUTION PREVENTION ACT

The Minnesota Toxic Pollution Prevention Act (TPPA), Minnesota Statutes § 115D, was signed into law on May 3, 1990. The TPPA establishes a new emphasis in environmental policy within the state of Minnesota. This new emphasis focuses on preventing pollution at the source in ways which minimize the transfer of toxic pollutants from one environmental medium to another.

The TPPA states the legislature's intention that the programs developed under this act encourage and lead to a greater awareness of the need for and benefits of pollution prevention. Further, it is Minnesota's policy that there be a greater degree of cooperation and coordination among all elements of government, industry, and the public in encouraging and carrying out pollution prevention activities.

In order to achieve these policy goals, the TPPA:

- ▶ Requires the Minnesota Office of Waste Management (OWM) to establish a pollution prevention assistance program;
- ▶ Authorizes the OWM to award matching grants to study or demonstrate the technical and economic feasibility of innovative pollution prevention methods and technologies;
- ▶ Authorizes the OWM to administer annual Governor's Awards for Excellence in Pollution Prevention;
- ▶ Requires facilities reporting releases of toxic chemicals under the federal Emergency Planning and Community Right to Know Act (SARA Title III, Section 313) to develop Toxic Pollution Prevention Plans and to submit annual progress reports to the Minnesota Pollution Control Agency (MPCA);
- ▶ Requires the OWM, in cooperation with the MPCA and the Minnesota Emergency Response Commission (ERC) to report to the legislature annually on progress being made in achieving the objectives of the TPPA; and
- ▶ Assesses pollution prevention fees on large quantity generators of hazardous waste and on facilities reporting toxic chemical releases under the Emergency Planning and Community Right to Know Act.

2. REQUIREMENT TO PREPARE REPORT ON BARRIERS TO POLLUTION PREVENTION

The TPPA also requires the OWM to prepare a report on barriers to pollution prevention in Minnesota. Specifically, the OWM is directed to "prepare and submit a report to the environment and natural resources committees of the legislature analyzing the barriers to pollution prevention. At a minimum, the director shall report on regulatory, economic, educational, and institutional barriers and shall recommend strategies to overcome these barriers. Further, the report shall describe ways in which government may serve as a role model in pollution prevention." This Report on Barriers to Pollution Prevention is in response to this legislative requirement.

a. Summary of Research and Analysis Efforts

In developing the findings of this report, OWM staff researched and analyzed numerous issues related to pollution prevention. Sources of information include:

- ▶ Extensive literature review of relevant published materials (references are listed at the end of each chapter);
- ▶ Discussions with the Minnesota Pollution Prevention Task Force, an advisory group consisting of 15 representatives from industry, labor, academia, environmental groups, and local and state government;
- ▶ Two public forums held at the state capitol, one addressing regulatory barriers to pollution prevention, and another addressing educational barriers to pollution prevention;
- ▶ Interviews and discussions with experts on specific subject matters;
- ▶ Input from other governmental agencies, in particular the MPCA and the University of Minnesota;
- ▶ Participation at interstate meetings, including the National Roundtable of State Pollution Prevention Programs, EPA Region V, and EPA Pollution Prevention Division training sessions;
- ▶ Survey results from the 1989 Minnesota Plan of Action project. Through surveys and other research techniques, an independent evaluation of the effectiveness of Minnesota's present waste reduction programs was conducted. Recommendations were made to modify and improve the state's pollution prevention programs.

Discussions with professionals from numerous fields and interest groups were conducted. The result of this research, discussion and analysis is this report on barriers to pollution prevention.

b. Premise and Overview of Report Content

This report recognizes that there is great potential for progress in preventing pollution in Minnesota. It is the premise of this report that Minnesota is not taking advantage of many opportunities to prevent pollution because of unnecessary regulatory, economic, educational, and institutional barriers. The purpose of the report is to identify barriers to pollution prevention and to recommend strategies for overcoming them.

The report consists of chapters addressing specific areas in which barriers to pollution prevention may exist. Chapters are divided in accordance with the statutory language mandating this report: regulatory, economic, educational, and institutional. A final chapter describes ways in which government can serve as a role model in pollution prevention.

B. DEFINING POLLUTION PREVENTION

Minnesota Statutes § 115D.02, subdivision 8 defines pollution prevention as "eliminating or reducing at the source the use, generation, or release of toxic pollutants, hazardous substances, and hazardous wastes." The key phrase in this definition is at the source. Pollution prevention involves taking measures to address pollution at its source of generation. Pollution prevention aims at eliminating toxic pollutants before they are created. By preventing pollution, a waste or emission is not generated in the first place. It is this definition of pollution prevention that is used in this report.

Pollution prevention approaches range from simple methods and techniques to advanced technologies. Simple preventive applications may include such things as covering exposed containers of volatile chemicals or tightening loose and leaking pipe connections (i.e., good housekeeping). Other low-tech options include personnel training, improved business operations and inventory control practices. More sophisticated or comprehensive pollution prevention applications include substituting raw materials (e.g. switching hazardous organic-based solvents to water-based or aqueous materials), redesigning manufacturing processes, increasing the efficiency of production, or redesigning and reformulating products.

Pollution prevention is an environmental approach fundamentally different from approaches that focus on managing or controlling pollution after it has been generated. Stopping pollution before it is generated, rather than trying to manage, control or clean it up afterwards, is the idea behind pollution prevention. Pollution prevention occurs prior to the creation of a waste or a pollutant, and thus occurs prior to the consideration of alternatives such as pollution control, waste management, treatment, recycling or disposal.

The health care field provides a useful analogy in distinguishing pollution prevention from other environmental strategies such as pollution control, treatment, or disposal. "Preventive medicine" focuses on behavioral and lifestyle choices such as diet and exercise, and other factors within control of the individual that help prevent disease. If illness is contracted, approaches such as medication or surgery must be used to cure or

address medical problems. Such approaches often cost more and involve higher risks and greater potential for side effects than preventive approaches.

The overall health of a society requires aggressive attention to both approaches. This is analogous to the situation in environmental protection in which preventive approaches are preferable to control, treatment, or disposal of pollutants. However, the key to a healthy environment is a comprehensive set of approaches used to address a wide range of situations.

C. MINNESOTA'S ENVIRONMENTAL CHALLENGES

The TPPA is a key element of Minnesota's strategy to address the environmental challenges facing businesses and industry in the state. Each year, Minnesota businesses generate over 100,000 tons of hazardous wastes that ultimately must be treated, incinerated or landfilled. Minnesota's Capacity Assurance Plan calls for achieving a 40 percent reduction rate in the generation of hazardous wastes by the year 2009. With landfill capacity quickly dwindling, and given the great difficulties involved in siting new facilities, it is imperative that government, industry and the public work together to meet this goal.

In calendar year 1989 alone, manufacturing plants reported that toxic chemical releases totaling over 80 million pounds were released to Minnesota's air, water and land. This data, reported under the Emergency Planning and Community Right-to-Know Act, shocked industry, government and the public. Pollution prevention represents a key strategy for reducing these releases.

Industry and government are learning that we cannot continue to rely solely on "end-of-pipe" actions such as pollution control and waste management to protect our environment. By managing or controlling problems after they have been created, we run the risk of only partially addressing them, and later finding that our approaches have unintentionally become sources of other problems. One example is the use of scrubber and baghouse systems to capture air pollutants. These systems generate solids containing toxics which then must be disposed of on land.

Industry and government agencies are now recognizing the need for a new comprehensive strategy to achieve significant environmental results. The cornerstone of this emerging environmental approach is pollution prevention. Increasingly, people see pollution prevention as a vital tool to supplement our pollution control and waste management efforts.

According to the United States Environmental Protection Agency (EPA), current U.S. spending on pollution control activities exceeds \$100 billion and accounts for about 2.1 percent of total Gross National Product (GNP). By the year 2000, it is estimated that these costs are likely to increase by 85 percent. The huge costs of pollution control point out the need for alternatives to generating pollution in the first place.

It is important to note that pollution prevention as an approach is applicable to activities and actions that go beyond an industrial scope. At the present time, the TPPA focuses on industrial sources of wastes and toxic chemical releases. However, pollution prevention as an environmental protection strategy is applicable to such societal activities as agriculture, transportation, energy production (and conservation), and domestic and household activities. As efforts to implement pollution prevention continue, the scope of pollution prevention should be broadened to include these and other arenas.

D. RATIONALE FOR POLLUTION PREVENTION APPROACH

A concise expression of the rationale for this new emphasis on pollution prevention is contained in the Findings and Policy section of the Pollution Prevention Act of 1990, passed by Congress on October 7, 1990, and signed by the president as part of the budget reconciliation bill. These findings state in part:

- ▶ The United States of America annually produces millions of tons of pollution and spends tens of billions of dollars per year controlling this pollution;
- ▶ There are significant opportunities for industry to reduce or prevent pollution at the source through cost-effective changes in production, operation, and raw materials use. Such changes offer industry substantial savings in reduced raw material, pollution control, and liability cost as well as help protect the environment and reduce risks to worker health and safety; and
- ▶ The opportunities for source reduction are often not realized because existing regulations and the industrial resources they require for compliance focus upon treatment and disposal, rather than source reduction. In addition, existing regulations do not emphasize multi-media management of pollution. Also, businesses need information and technical assistance to overcome institutional barriers to the adoption of source reduction practices.

E. BENEFITS OF POLLUTION PREVENTION

The most obvious benefit of pollution prevention is a cleaner environment. Today, the environment is a global issue. Concerns over stratospheric ozone depletion and global warming are heightening the stakes and making it essential that everyone become part of the solution. Pollution prevention can, however, unleash benefits that go far beyond our goal of safeguarding the environment.

Environmentally aware companies know that pollution prevention does more than protect the environment: it also makes good economic sense. Pollution prevention is significant because in many instances it is a cost effective approach which can pay dividends to companies instituting such practices. Sharply escalating waste disposal and clean-up costs can be avoided by not generating wastes in the first place. Long-term "cradle to grave" liabilities linked with hazardous wastes and ever-increasing pressures to comply with stringent environmental regulations can be decreased if opportunities are seized to prevent wastes. By improving operations, businesses are finding that expensive

raw materials and energy are conserved through pollution prevention. And, because increases in product quality and customer satisfaction are common results of pollution prevention projects, companies often improve their competitive positions in the market. Pollution prevention presents as a "win-win" situation in which both the company and the environment benefit. Pollution prevention holds the promise of substantially reducing toxic chemicals in our environment and linking these efforts with environmentally sustainable manufacturing and economic development. While these benefits are impressive, the potential for additional payback is even greater.

Companies are also motivated to carry out pollution prevention actions to find alternatives for substances that may become regulated in the near future. And, pollution prevention can create positive community relations as neighbors see that companies are being proactive by preventing pollution from being generated.

F. CONCLUSION

Minnesota's vision is to develop an integrated approach to preventing pollution at its source. The vision must be supported and implemented by all sectors of society, including industry, the public, government, and educational institutions, if it is to be realized. Further, pollution prevention as an environmental strategy is applicable not just to industry, but to a broad range of societal activities (e.g., energy, agriculture and transportation issues). Aggressive implementation of pollution prevention offers great opportunities for enhanced environmental protection and increased industry efficiency and economic health. Achieving this vision will require an understanding and elimination of barriers to pollution prevention.

II. REGULATORY BARRIERS

A. INTRODUCTION: PROBLEM STATEMENT AND CONTEXT

1. BACKGROUND: REGULATIONS AND THE ENVIRONMENTAL PROTECTION HIERARCHY

The legislative mandate for this chapter is to examine the ways in which the current system of environmental regulations presents barriers to the implementation of pollution prevention approaches to environmental protection. The chapter recommends strategies to overcome regulatory barriers to pollution prevention.

To provide the proper context for this analysis, an overview of the goals and historical development of the current environmental regulatory system is important.

The goal of environmental regulation is to protect human health and the environment from harmful contamination of air, water and land. Over the past 20 years a complex system of laws, regulations, permits, licenses, reporting requirements, data-bases, inspection programs, and enforcement activities has developed to pursue this goal. For valid reasons, this system has been developed through media-specific approaches (e.g., Clean Air Act, Clean Water Act, Resource Conservation and Recovery Act, Safe Drinking Water Act). In general, this system emphasizes treatment or appropriate containment of pollutants rather than prevention. The widespread use of air pollution control and wastewater treatment equipment and land disposal facilities demonstrate the reliance on these "end-of-pipe" measures.

In general, this system is accomplishing many of the goals that have been the target of its activities and a great deal of progress has been made over the past 20 years. Recently, however, there has developed a consensus in many states (including Minnesota) and at the federal level that more needs to be done within the regulatory system to encourage approaches which prevent pollution at its source. One consequence of this consensus has been the development of a "hierarchy" of environmental protection practices. The United States Environmental Protection Agency (EPA) Pollution Prevention Policy Statement (EPA, 1991) summarizes this hierarchy as follows:

- ▶ Pollution prevention or source reduction;
- ▶ Recycling;
- ▶ Treatment or control; and
- ▶ Safe disposal of any remaining residuals.

Pollution prevention, as defined at both the federal level and in Minnesota, focuses on eliminating or reducing at the source the use, generation, or release of toxic pollutants, hazardous substances, and hazardous wastes. Preventive approaches reduce the use of hazardous and nonhazardous chemicals that produce pollution, and they minimize the transfer of pollution from one environmental medium to another. While the pollution prevention approach is at top of the hierarchy, it is by no means the only useful approach to environmental protection. Pollution prevention, while having unique

strengths which are discussed in this report, is not a panacea for environmental protection which will replace all other methods.

Pollution prevention specifically differs from pollution control and recycling in that pollution prevention addresses pollutants at the source or before they are generated or released into the environment. Pollution control, recycling, treatment, and safe disposal focus on pollutants at the "end-of-pipe" or after they have been generated or released.

Interest in developing additional incentives for pollution prevention stems from four major sources:

- ▶ It is recognized that while existing regulatory approaches have resulted in significant gains, present and future problems, such as toxic chemical releases from many small sources, may not be amenable to traditional solutions;
- ▶ There is widespread consensus that there are many cost effective opportunities for pollution prevention and that these solutions are not being utilized by hazardous chemical users and generators because of "unnecessary" economic, educational, regulatory, and institutional barriers.
- ▶ Minimum standards have not yet been established for many contaminants. Many existing ambient standards are based on acute human health effects and do not reflect the potential for chronic exposure or bioconcentration in the food chain.
- ▶ Treatment may not completely destroy a contaminant but merely alter its form. As a consequence, other pollutants (e.g., sludges and ash) are generated, requiring further treatment or disposal.

2. CURRENT EFFORTS TO ADJUST THE REGULATORY SYSTEM

Efforts are currently underway at both the state and federal levels to integrate pollution prevention more fully into existing environmental protection programs. States are widely acknowledged to be leading the federal government in these efforts.

In Minnesota, pollution prevention programs have been administered by state agencies for some time, although sometimes under different names. Created in 1984, the Minnesota Technical Assistance Program (MnTAP) is a nationally recognized program which has been at the forefront of encouraging pollution prevention. In addition, financial assistance for research and development on waste reduction has been provided by the Office of Waste Management (formerly the Minnesota Waste Management Board) since 1984. The Minnesota Pollution Control Agency (MPCA), through a federal grant, has operated a hazardous waste minimization project since January 1989. The emphasis of this program has been targeted at solvent waste generators.

In terms of multi-media pollution prevention activities, the MPCA has been issuing a limited number of coordinated permits between media for several years. Multi-media

issues have been addressed as part of the process of environmental review since the early 1970s. Superfund cleanup actions are now routinely reviewed to assure that they do not result in cross-media transfers. Several MPCA staff committees meet routinely to consider cross-media issues. In addition, the MPCA's draft waste-combustor rules include requirements for mercury reduction plans and waste composition studies. These requirements are examples of how the existing regulatory system can enhance pollution prevention activities.

Over the past two years, approximately a dozen states (including Minnesota) have passed legislation specifically addressing pollution prevention. The signing into law of the Toxic Pollution Prevention Act (TPPA) in May, 1990, places Minnesota at the forefront of state efforts to promote pollution prevention. Since passage of the TPPA, the MPCA has been evaluating how pollution prevention can be integrated into the existing regulatory system. The MPCA has designated a coordinator to orchestrate the activities in this area. A staff team has been created with technical and high-level representatives from each division. This committee meets biweekly to analyze ways of integrating pollution prevention into ongoing MPCA activities. Pollution prevention techniques are being applied with increasing frequency in ongoing regulatory programs.

Efforts at the federal level have also gained momentum. A national Pollution Prevention Act was passed by Congress in the last hours of the 1990 session. This act establishes the pollution prevention hierarchy as national policy and calls pollution prevention a "national objective." EPA is directed to facilitate the adoption of source reduction techniques by business and government through various activities which include establishing an \$8 million state grant program, reviewing its regulations to determine their effect on pollution prevention, and other activities.

Although EPA has recently begun to incorporate a pollution prevention perspective into its programs, it is widely recognized that EPA remains inconsistent in promoting the pollution prevention message through its various layers and regions (Editors, Inside EPA, 1990). EPA has recently written a pollution prevention strategy (EPA, 1991) which provides guidance and direction for efforts to incorporate pollution prevention into EPA programs, and sets forth a program to achieve specific pollution prevention objectives within a reasonable time-frame. EPA's Science Advisory Board has also recently released a report entitled Reducing Risk: Setting Priorities and Strategies for Environmental Protection (EPA Science Advisory Board, 1990) which recommends pollution prevention as the preferred option for reducing risk.

Another example of EPA's move toward incorporation of pollution prevention into its activities is the recent effort to obtain public comment on how hazardous waste regulations can better provide industry incentives to reduce or eliminate the generation of hazardous waste.

Finally, EPA and Environment Canada, the federal environmental agency of Canada, will announce the bilateral pollution prevention plan for the Great Lakes in March, 1991. It is anticipated that this plan will include active involvement from Minnesota state agencies. The focus of this strategy is on preventing the generation of persistent toxic

pollution. While the Great Lakes initiative does not presently identify specific activities to be conducted within Minnesota, the MPCA is presently contemplating a multi-media inspection/enforcement program within the Great Lakes Basin portion of the state. That program is expected to incorporate a strong pollution prevention emphasis.

3. THE CONTINUING CHALLENGE: FOSTERING POLLUTION PREVENTION THROUGH REGULATORY CHANGES

In spite of the progress of current regulatory approaches to protecting the environment and recognizing the current attempts to integrate pollution prevention incentives into existing programs, there is a potential for certain elements of the existing regulatory programs to create barriers or disincentives to pollution prevention. For example, the findings of the recently passed federal Pollution Prevention Act state:

"The opportunities for source reduction are often not realized because existing regulations, and the industrial resources they require for compliance, focus upon treatment and disposal, rather than source reduction; existing regulations do not emphasize multi-media management of pollution..."

The relationship between the current regulatory system and pollution prevention as an approach to environmental protection is complex, especially at a time when the system is evolving to include greater emphasis on such approaches. At least three types of situations can be identified:

- ▶ Regulations or the way in which they are implemented sometimes present a direct legal or economic incentive to select pollution prevention approaches over recycling, treatment, or disposal. Examples include the requirement to develop a plan in the Minnesota Toxic Pollution Prevention Act, source separation requirements in draft waste-combustor rules, and required mercury reductions in batteries. Because the purpose of this report is to discuss barriers, not incentives, no attempt has been made to fully catalogue these efforts.
- ▶ Regulations or the way in which they are implemented sometimes present a direct legal or economic barrier to pollution prevention approaches. Primary examples include technology-specific mandates which preclude preventive approaches in favor of specified end-of-pipe treatment, and unnecessary regulatory inflexibility in working to solve specific pollution problems.
- ▶ Some regulatory factors are neutral in terms of direct economic or legal requirements, but may present either incentives to pollution prevention approaches or barriers depending on the specific economic, technological and institutional conditions under which the regulatory factors are being implemented. This encompasses the great bulk of regulatory activity as will be described in the next section of the chapter. Examples include end-of-pipe effluent or emissions limits or management requirements, single media regulatory approaches, and data gathering systems.

Several recent studies have focused on existing regulatory requirements that serve as disincentives to the reduction of pollution and wastes. These studies include Serious Reduction of Hazardous Waste (US Congress Office of Technology Assessment, 1986), Hazardous Waste Source Reduction: Industry Perception of Regulatory and Other Impediments (Harrison, 1989), and From Poison to Prevention (Lewis and Marco, 1989).

It should be emphasized that the barriers discussed in this chapter are not unique to Minnesota and are not reflective of the quality and effectiveness of Minnesota's environmental regulatory agencies. Instead, many of these barriers have evolved from national environmental laws and regulations and from regulatory requirements which have developed out of a paradigm of environmental protection which is based on control rather than on prevention.

B. ANALYSIS OF REGULATORY BARRIERS

1. END-OF-PIPE FOCUS

As noted in the introduction, regulatory programs have legitimate reasons for being focused on treatment, handling and storage, and disposal rather than on pollution prevention. In most instances, this end-of-pipe focus does not create a direct barrier to industries who choose to implement pollution prevention. The exception is in cases where regulations specify a particular end-of-pipe technology to achieve compliance with regulatory requirements. In fact, stringent and aggressively enforced end-of-pipe requirements can present significant incentives for pollution prevention. Strict waste management requirements, effluent standards, and emission limits may raise costs for end-of-pipe solutions to such a high degree that preventive options are viewed as the most effective and economical choice. Aggressive enforcement of existing regulations, even though they generally focus on end-of-pipe measures of success, can offer significant incentives for pollution prevention.

However, under certain circumstances this focus on end-of-pipe measures can pose direct or indirect barriers to expanded pollution prevention efforts.

a. Direct Barriers: Regulatory Mandates For Certain End-Of-Pipe Measures

Regulatory policies such as Best Available Control Technology (BACT) for air emissions and Best Demonstrated Available Treatment (BDAT) in hazardous waste regulations are in many cases based on specific control and management technologies. These policies do not always recognize the validity of environmental gain through process change, product modification, or raw material substitution and sometimes require a specific end-of-pipe technology as the only allowable solution. This approach discourages prevention activities which can be equally or more successful than end-of-pipe applications. Specifying the use of specific technologies reduces flexibility of innovation.

In some cases, BACT determinations are based on historical analysis of a process and the control technology applied to it. There may be a lag in time between the BACT

technology and real-world developments. In addition, an economic analysis is also often required. Techniques for evaluating the costs and benefits of a pollution prevention technique, in comparison to end-of-pipe controls, are not well developed.

Pollution prevention techniques at one point in a process line may also result in reductions in pollution throughout succeeding portions of the process. These reductions may not be reflected in a BACT-mandated economic analysis which is intended to determine the cost-effective control measure of some subset of that process. Application of BACT requirements might also mandate a specific pollution control measure of the specific unit due to the inability of the system to recognize and credit the overall reduction on the system.

EPA has recently recognized the potential significance of BDAT requirements as an incentive for pollution prevention. In its October 5, 1990 request for public comment on waste minimization incentives, EPA specifically requested comment on the advisability of including pollution prevention options as part of BDAT determination.

b. Indirect Barriers: Priorities and Perspectives in Environmental Protection Strategies

The majority of existing regulations are structured with an end-of-pipe perspective. The overwhelming proportion of regulatory resources are, therefore, directed to assuring the proper management of wastes after generation, developing and enforcing effluent or emission limits, and cleaning up problems caused by past practices. This can have the indirect effect of focusing industry efforts on pollution control rather than pollution prevention. This focus has tended to lead in many instances to a focus on end-of pipe solutions on the part of policy-makers, regulators, consultants, engineers, and business decision-makers.

The resources of the regulatory system have generally not been committed to solving problems through process change, raw material substitution, or product modification. This focus could also suggest to the regulated community that pollution prevention as an approach to environmental protection is a lower priority, only important for those with special problems, interests, or expertise. Companies choosing to do the minimum necessary to comply with government expectations may logically focus on end-of-pipe actions and place a lower priority on investigating preventive opportunities. As stated above, this end-of-pipe focus does not, in most cases, create a direct barrier to pollution prevention.

End-of-pipe focus is also evidenced by the limited nature of the current state requirement to prepare pollution prevention plans (and by the lack of any such requirement at the federal level). This requirement is currently limited to a small segment of Minnesota industry, specifically facilities required to complete toxic chemical inventories (TRI) to report releases to the environment (approximately 425 facilities in Minnesota to date). Other facilities which generate or release significant quantities of toxic pollutants (e.g., large quantity hazardous waste generators not required to report under TRI) are not required to prepare plans.

A second way in which the current planning requirement may be an indirect barrier is that implementation of pollution prevention plans is voluntary and plans are kept confidential by the facilities which prepare them, except in cases in which annual progress reports are considered inadequate and plans are subject to review by the MPCA. This "soft" regulatory approach, relying to a great extent on voluntary compliance, differs from many other regulations relating to end-of-pipe or media-specific requirements.

Some indirect barriers are associated with the limited planning requirements, the voluntary nature of adherence to plan goals, and the confidentiality of the plans. Limited planning requirements leave facility pollution prevention planning totally up to the facility management, which may not consider this effort to be of importance, despite the many economic and quality benefits which can accrue to facilities which undertake pollution prevention planning. Voluntary adherence to plan goals may allow target reductions to be taken less seriously and may reduce the likelihood that serious pollution prevention efforts will be undertaken. Similarly, the confidentiality of the plans may tempt some facilities to prepare poorly thought-out plans, or even not to prepare a plan at all. These factors can result in less pollution prevention activity in Minnesota and therefore may be considered to be indirect barriers.

2. MEDIA-SPECIFIC FOCUS

The structure of the regulatory system has developed in response to federal and state laws which concentrate on one environmental medium: air, water, or land. Concentration on single media has been a logical and reasonable outgrowth of the varying physical characteristics and environmental problems associated with different pollutant pathways. For example, emissions to air can travel over long distances while discharges to land are generally more localized. A programmatic emphasis on a single medium is not necessarily a direct barrier to pollution prevention actions at the facility level. Facilities which are interested in planning and implementing pollution prevention strategies are not precluded from doing so because they are regulated under media-specific programs. In fact, as in the case of the end-of-pipe focus, existing media-specific programs can be an incentive for pollution prevention approaches.

However, a media-specific focus can often lead to concentration on media-specific solutions rather than on approaches which reduce releases at the source. The consequence of this orientation is that it can occasionally fail to prevent an undesirable transfer of pollution from one environmental medium to another. The potential exists for media-specific activities (e.g., permits, inspection or enforcement) to allow for or even encourage transfers of pollutant releases from one environmental medium to another. Since media-specific programs do by definition concentrate only on discharges or releases to one medium, there is opportunity for facilities to meet the requirements of a medium-specific program by shifting releases to another medium. For example, a standard solution for air emissions has been to transfer pollutants through use of air pollution control equipment to water or landfills. While some cross-media transfers can result in net reductions in environmental impacts, others may merely shift the problem and result in little or no net gain in environmental quality. An emphasis on multi-media preventive approaches has the potential of eliminating or reducing cross-media transfers.

A number of recent reports have addressed the potential problem of media-specific focus. For example, Fragmentation and Integration in State Environmental Management (Rabe, 1986) has identified obstacles associated with media-specific efforts. Others are discussed in Integrated Pollution Control in Europe and North America (Haigh and Irwin, 1990). Dr. Mahesh Podar's report Integrated Permits and Multi-Media Pollution Prevention (Podar, 1990) states that there are a large number of cases in which compliance with a media-specific requirement has resulted in increased releases to other media.

Media-specific regulatory programs, while not presenting a direct barrier to holistic, multi-media preventive solutions, do not necessarily encourage such solutions without special efforts on the part of regulators and the regulated community. Multi-media preventive efforts, such as coordinated permitting, multi-media inspections, and/or pollution prevention planning can help to examine and address the total environmental releases of a facility. In order to best plan for pollution prevention, it is necessary to take a facility-wide perspective. Close coordination between media programs can assist facilities in achieving this goal.

3. REGULATORY PROGRAM EVALUATION CRITERIA

Program evaluation criteria used by EPA to assess the success of environmental protection programs delegated to state agencies create another key indirect barrier. Program evaluation can be a strong motivating force for government agencies and other organizations. However, current benchmarks for measuring the success of state environmental programs by EPA do not include consideration of pollution prevention progress. In addition, program evaluations are not based on the amount of environmental improvement. Rather, the focus is on more easily quantified performance measures such as the number of permits issued or the number of inspections performed. There is therefore pressure to allocate resources based on increasing reported benchmarks rather than on activities directly related to pollution prevention.

4. REGULATORY INFLEXIBILITY

Regulatory inflexibility can be either an incentive or a barrier to pollution prevention, depending on the particular situation. Regulatory inflexibility in the sense of consistency, due process, and equal treatment of similar situations is a key to effective regulation and to providing incentives for pollution prevention. There is great value in regulatory inflexibility in terms of requiring quick and decisive response to threats to the environment and assuring equal protection under the law. Strong and consistent enforcement of all environmental regulations provides a context which creates additional incentives for companies to initiate pollution prevention activities.

On the other hand, a lack of flexibility can sometimes create a barrier to pollution prevention. Pollution prevention is a customized process, varying facility by facility. At times, this may require flexibility and short-term variances in compliance schedules for emission standards or permits.

Flexibility in terms of time is particularly important for encouraging genuine industry prevention efforts. Rigid timetables can present a barrier to pollution prevention. Time constraints included in permit requirements typically require that effluent limits or other measurable conditions be satisfied within a relatively short time. While many pollution prevention activities are "low-tech" and easy to implement, permit time constraints, for example, may not be sufficient to allow for the design and implementation of major preventive applications such as process modifications or product reformulations.

In some pollution prevention applications, customized new or experimental technologies may need to be developed and may involve modifications to several production processes. Risk exists that modifications which may not be successful could result in difficulties with compliance after they are completed. In cases of demonstrated need by industry, allowing flexibility for short-term exceedences in pollution resulting from implementation of prevention activities can pay off in long-term environmental gains.

In its Draft Interim EPA Policy on the Inclusion of Pollution Prevention Provisions in Enforcement Settlements (EPA, 1990a.), EPA recommends giving settlement teams additional flexibility in negotiating an implementation schedule. This policy recognizes that "pollution prevention alternatives sometimes add an element of complexity to a facility-specific compliance strategy, especially if it involves new or innovative technology." The length of time is to be "expeditious" but this is left to be a "best judgment" decision on the part of EPA negotiators.

5. REGULATORY UNCERTAINTY

a. Multiple Layers of Authority to Regulate Cause Confusion

Industry personnel working to implement pollution prevention strategies may be required to consult with several agencies with decision-making authority. An innovative project or a pollution prevention proposal may require multiple approvals for different aspects of that project which may be difficult to obtain. This can discourage facilities from undertaking pollution prevention practices.

Agencies with authority to administer regulatory activities exist at many levels of government: federal, state, county, and municipality. Each level of government can promulgate environmental regulations. Occasionally, differences and contradictory requirements result. For example, a difference in interpretation of hazardous waste rules with respect to facilities discharging to wastewater treatment facilities (sanitary sewer system) has confused some waste generators as to their regulatory and fee status. Inconsistencies can present a barrier to pollution prevention. Different agencies or levels of government may have rules or programs which impact specific aspects of a project, and these rules may result in conflict.

b. Uncertainty Regarding Changes in Regulatory Requirements

Industry is concerned about the possibility that pollution prevention may evolve from its current voluntary status to a more regulatory approach. If industry perceives the setting of mandatory reduction rates in the future, some may elect to delay implementation of pollution prevention. They may fear that immediate implementation of prevention measures may reduce the number of actions that could be taken if mandatory reduction regulations are promulgated in the future. Companies also may wish to receive credit for reduction in the future as well as to relieve themselves of the burden of reducing even more.

6. FEE SYSTEMS

If appropriately structured, environmental fees can provide incentives for implementing pollution prevention projects. If structured on a multi-media basis with a significant correlation to quantities of pollutants created (or toxic chemicals used), and if set at sufficient levels, fees can provide facilities with incentives to go beyond minimum environmental standards.

Current fees are for the most part media-specific. These fees are set at levels based on costs for regulatory services. In some instances, they are not closely correlated with quantities of pollutants released or toxic chemicals used. Although fees administered in this way do not present direct barriers to pollution prevention activities, they can act as indirect disincentives for facilities to implement preventive applications in that the fee may remain the same or change very little regardless of success at reducing releases or chemical use.

Fees also tend to be low relative to facility operating costs. Fees for regulatory activities such as permits, inspections, and violations are typically not high enough to provide significant incentives for going beyond required standards.

7. DATA GATHERING AND MANAGEMENT ISSUES

Data gathering and management systems have generally developed along media-specific lines. They focus on end-of-pipe emissions and quantities of waste generated as a means of enforcing and ensuring compliance with existing regulatory requirements. This has been a legitimate and rational response to the requirements of environmental protection as outlined in statute and policy. The fact that data have been collected and managed in this way is not a direct barrier to pollution prevention in the sense that it prohibits facilities from undertaking such activities. Media-specific data that are aggressively collected and evaluated can be a key element in effective regulations, and as such can be viewed as an incentive to pollution prevention activities.

On the other hand, the reporting, management and analysis of data does not provide a context which necessarily encourages or facilitates multi-media preventive approaches. While data are collected with which to evaluate progress in pollution control or waste management, multi-media preventive data that are important in identifying progress in

pollution prevention are not being collected. The lack of such data presents a barrier to regulators and policy-makers wishing to assess program success. The lack of a requirement to report data in this way does not encourage facilities to look at environmental impacts from the holistic perspective of pollution prevention. Reliance on single-media data can mask cross-media transfers and make conclusions about overall environmental impacts difficult. In Integrated Permits: What are the Data Requirements? (Cummings-Saxton, 1990), a paper prepared for EPA in September 1990, the current data available are carefully analyzed. Data shortcomings which impede multi-media integrated permitting are identified in this study.

The newly developed Toxic Chemical Release Inventory (TRI) data base, developed in response to the Emergency Planning and Community Right to Know Act, provides the only multi-media data base currently available. Unfortunately, present TRI reporting requirements do not provide sufficient data for comprehensive regulatory, policy and planning purposes. The TRI requirement affects manufacturers with more than 10 employees using or processing greater than threshold quantities of listed chemicals. The Minnesota Emergency Response Commission (ERC) submitted a report to the Legislature in December 1990 containing its recommendations for inclusion of additional facilities into the reporting requirement for Minnesota. Some states such as Massachusetts and New Jersey have expanded or plan to expand their reporting requirements. EPA is also evaluating the expansion issue. The federal Pollution Prevention Act will expand the TRI reporting requirements for off-site transfers, including transfers for recycling and reuse which are currently not reported. This additional reporting requirement is slated to begin in calendar year 1992. The new federal law will also require mandatory reporting of source reduction practices for reported chemicals, ratios of production as compared to previous years, and other information.

The value of TRI data is limited because it is not always reported in a way which makes it comparable with other data bases. For example, hazardous waste generation data for TRI are reported based on individual chemical constituents. This is limited to the estimated weight of a specific listed chemical. However, for the "manifest" and "minimization" data bases, hazardous wastes are assigned to four-digit waste RCRA codes. The total weight of the hazardous waste (including non-listed chemicals) is reported. This total weight can include water and other non-hazardous materials. Reporting procedures vary among agencies. This can require the unnecessary expenditure of resources by industry and may also lead to confusion and error. In addition, some reports may not be filed because of duplication or overlapping requirements between differing agencies. Many facilities have difficulty in filing correct TRI reports. This may be due to the different formats between various data reporting forms.

The value of TRI data for a comprehensive view of pollution prevention progress is also reduced because it is a fairly new requirement and non-reporting of data by facilities is a significant issue. According to Phantom Reductions: Tracking Toxic Trends (Poje and Horowitz, 1990), noncompliance is a serious problem. The report states that up to a third of facilities required to report releases fail to file required TRI reports.

Another feature of current data gathering efforts is that there is no requirement to report on facility use of toxic chemicals. TRI reporting provides data on toxic chemical releases and waste generation. TRI reporting does not provide data on the total annual amount of toxic chemicals used by a facility.

The legislature has directed the OWM to prepare and submit a report evaluating the utility of requiring companies to prepare toxic pollutant use reports and reduction plans. This report is required to be submitted by January 1, 1993. In addition to addressing the issue of use data and reduction plans, the burden placed on industry and the regulatory system will be analyzed. States such as Massachusetts, New Jersey and Oregon currently require reporting of use data. The efforts to collect, analyze and develop policies and programs based on such data are still quite new and undeveloped. Use data have the potential to offer perspectives on the balance of chemicals entering and exiting the facility, including production efficiencies and front-end production information not provided by toxic chemical release or waste generation data. In the OWM report, the benefits to be gained from a requirement to report such data will be analyzed as will the costs and problems associated with its collection.

The need for improved data relating to pollution prevention has been recognized at both the federal and state level. The federal Pollution Prevention Act requires the EPA administrator, as part of a strategy to promote source reduction, to "develop improved methods of coordinating, and assuring public access to data collected under federal environmental statutes." The MPCA has also taken initial steps toward this goal with its proposed Master Entity file project. Massachusetts has instituted a program setting up a "Facility Master File" in which all information is compiled on a facility basis and placed in a single and comprehensive database. Massachusetts' effort involves integrating 26 existing data bases into one data base and undertaking the process of data reconciliation. When completed, it is anticipated that this data base will provide a better indication of movement of toxic chemicals between environmental media.

C. RECOMMENDATIONS

1. THE MPCA SHOULD CONTINUE TO INTEGRATE POLLUTION PREVENTION INTO THE REGULATORY SYSTEM

a. Continue Work to Integrate Pollution Prevention

MPCA staff should continue active work to integrate pollution prevention into all MPCA programs and activities, including rulewriting, permitting, inspections, and enforcement. This work could include the development of an agency-wide policy statement indicating that pollution prevention is a priority approach to environmental protection and that the agency is committed to providing incentives for pollution prevention to the fullest extent consistent with its mission. The draft EPA Pollution Prevention Policy Statement may serve as a model for this effort.

MPCA staff should also continue its work to develop an agency-wide strategy and work plan on pollution prevention. EPA's Pollution Prevention Strategy (EPA, 1991) is an

example of this action at the federal level. EPA Region V is developing a "Hazardous Waste Minimization Workplan." A third example is the New Jersey Department of Environmental Protection's document entitled Hazardous Substance Pollution Prevention: The Key to a New Era of Environmental Protection (New Jersey Department of Environmental Protection, 1989).

b. Establish Prevention Goals and Benchmarks

The MPCA should establish program goals and benchmarks for evaluation that relate to achievement of pollution prevention objectives. The MPCA is encouraged to work with EPA Region V to assure that measures of program success for EPA-delegated programs reflect the pollution prevention goals of EPA headquarters and Minnesota. MPCA should continue to work proactively with EPA to further integrate pollution prevention into EPA programs and activities. The recent joint memo from MPCA and the OWM in response to EPA's request for public comment on integrating pollution prevention into its hazardous waste programs is an example of this activity (Svanda and Robertson, 1990).

c. Evaluate Whether Increased Flexibility is Needed

MPCA staff should specifically evaluate whether increased flexibility in existing rules is needed to remove disincentives to pollution prevention. MPCA staff should further evaluate what form of changes is necessary and appropriate. One example of a program which can increase flexibility is the Massachusetts Innovation Waiver Program, authorized by that state's Toxic Use Reduction Act. This program is being designed to increase short-term flexibility for long-term reduction in the use of toxic substances. Waivers may be issued for any environmental law administered by the Massachusetts Department of Environmental Protection for up to two years if the facility will be in compliance with environmental laws through the application of toxics use reduction technologies. Another possible alternative for increased flexibility may involve the granting of variances by the MPCA Board.

d. Address Pollution Prevention in Rulemaking

Where appropriate, the MPCA should be encouraged to continue its efforts to incorporate pollution prevention into its rulemaking activities. The MPCA Air Toxics Technical Advisory Committee (ATTAC), a committee of representatives from interested parties with the purpose of advising MPCA staff during air toxics rulemaking, is a specific example of a rulemaking effort which is attempting to address the issue of incorporating pollution prevention into rulemaking efforts. Including consideration of pollution prevention in procedures for reducing air toxics emissions has been discussed. However, any inclusion of pollution prevention, even at the level of insuring that it is considered while not dictating its use, in a regulation, (rather than maintaining a strictly voluntary approach) remains extremely controversial.

e. Pursue Multi-Media Inspection and Enforcement as Appropriate

Multi-media regulatory activities can enhance pollution prevention opportunities. These actions can identify areas where cross-media transfers occur. MPCA staff is currently identifying permitted facilities which are high inspection priorities for more than one MPCA division. Targeting of priority facilities is proceeding on several different bases, among them specific industry, contaminant, and geographical location. A number of these facilities will be identified and will receive a coordinated inspection during fiscal year 1992 by appropriately constituted inspection teams. A strong emphasis on pollution prevention will be a part of the inspection, and facilities will be advised as to resources available for technical and financial assistance in pollution prevention. This pilot effort should receive the support of MPCA management and the legislature. The pilot effort should be evaluated to determine whether multi-media inspection is appropriate for other facilities. MPCA staff is also presently evaluating the feasibility of integrating pollution prevention into MPCA enforcement actions, and should continue to do so.

One example of a multi-media inspection project is the Massachusetts "Blackstone Project." The Blackstone Project is an ongoing pilot project which is investigating the advantages of inter-media cooperation in inspection and enforcement. Specifically, it has tested the use of multi-media inspectors versus single-media inspectors. Massachusetts found that inspectors trained in cross-media issues had more to offer companies in that they were better able to identify areas in which pollution prevention opportunities may exist. In addition, inspectors made referrals to technical assistance programs and other resources. Industry staff noted that multi-media inspections saved facility staff time.

f. Expand Multi-Media Permitting Where Appropriate

Multi-media permits can help to overcome the problem of transferring pollution from one environmental medium to another. This can represent a real opportunity for institutionalizing pollution prevention in regulatory program efforts. A limited number of cross-media permitting efforts have been undertaken by the MPCA. Coordination between media-oriented regulatory programs is accomplished on some projects at the MPCA through the process of environmental review. However, the environmental review process is not conducted on many industrial permits. An expansion of this coordination or the creation of some new mode of coordination could accomplish several functions:

- ▶ Identify potential impacts of proposed pollution abatement strategies on all media, allowing a comparative assessment of economic and environmental costs of respective impacts.
- ▶ Identify pollution abatement strategies which, because of multi-media impacts, are not acceptable.
- ▶ Identify potential pollution prevention strategies which might result in an overall reduction in environmental risks and impacts.

It is recommended that MPCA study the feasibility of establishing a program for multi-media permitting and that as a first step a pilot project be designed. Consideration could be given to designing a program which targets facilities with particularly significant toxic chemical releases. EPA's Industrial Toxics Project as discussed in the Pollution Prevention Strategy (EPA, 1991) outlines a program in which particular pollutants with risks to human health and the environment are targeted. Minimization of cross-media transfers can potentially result from integrated permitting programs.

g. Study Ways to Best Expand and Coordinate Data

It is recommended that MPCA consider establishing an internal task force to evaluate the use and management of environmental data. Consideration could also be given to evaluating the need for further support or refinement of the Master Entity File project which aims to consolidate all information on one company into one file. Appropriation of additional resources to better manage MPCA internal databases and to consolidate reporting forms and requirements and to address other data issues should be considered.

h. Consider Changes to Fee Systems

The MPCA should consider changes to fees that would provide greater incentives for pollution prevention activities. Regulatory fee structures should be assessed to examine ways to provide additional disincentives to pollution and incentives to pollution prevention. Fees can serve as incentives to pollution prevention if they directly compensate and reward companies which implement pollution prevention practices. One way in which this could be accomplished is if permit fees were reduced for facilities successfully implementing pollution prevention plans. Such an approach would be an incentive for facilities to exceed standards. Fee structures can provide disincentives to pollution discharges if fee schedules are made more directly proportional to quantities of waste generated or emissions released. This would add an additional incentive for facilities to exceed standards. When negotiating enforcement actions (e.g., stipulation agreements) the MPCA should also consider the utility of lowering fines in exchange for commitments to implement pollution prevention measures.

2. STATE PROGRESS IN IMPLEMENTING PREVENTION IN MPCA BIENNIAL REPORTS

The MPCA's biennial reports to the legislature (Minnesota Statutes § 116.10) should include statements of progress made in the implementation of pollution prevention. The biennial report should specifically identify pollution prevention strategies as one component in its long-range plan.

3. ADOPT RECOMMENDATIONS TO EXPAND TOXIC CHEMICAL RELEASE INVENTORY

The legislature should adopt the recommendations outlined in the Minnesota Emergency Response Commission's (ERC) report (Minnesota Emergency Response Commission,

1990) regarding the expansion of Toxic Chemical Release Inventory (TRI) reporting in Minnesota.

This report recommends expanding the requirement to submit TRI reports to various segments of non-manufacturing facilities, including metal mining, electrical services, chemicals and allied products, and others. It also recommends surveying facilities in other sectors as a guide for future expansion initiatives. This additional information would be a valuable complement to TRI data already being collected and would serve to promote preventive initiatives in Minnesota.

4. AMEND ACT TO REQUIRE ALL REPORTING FACILITIES TO PLAN

The legislature should amend the Minnesota Toxic Pollution Prevention Act to require all facilities reporting releases under Minnesota's TRI requirements to prepare pollution prevention plans and pay pollution prevention fees.

The current statute specifies only that those facilities reporting releases under the federal Emergency Planning and Community Right to Know Act be required to prepare pollution prevention plans and pay pollution prevention fees. At the present time, the state and federal statutes are identical in terms of the universe of facilities covered. However, the ERC has submitted a report to the legislature recommending expansion of the reporting requirements in Minnesota (see above recommendation). If legislation is passed to accomplish this, the Minnesota Toxic Pollution Prevention Act should be amended to require these new facilities to prepare pollution prevention plans and pay pollution prevention fees.

5. AFFECTED GROUPS SHOULD TAKE STEPS TO IMPROVE COMMUNICATION

Because of the predominantly voluntary nature of Minnesota's pollution prevention strategy to date, progress depends in an important way on good communication and an atmosphere of partnership between affected parties. The importance of healthy communication and trust is an argument for retaining a strong voluntary, flexible component in pollution prevention activities. Adversarial attitudes can easily paralyze the system, leading as discussed in the analysis section of this chapter, to such barriers as inflexibility and reluctance to go beyond standards.

State agencies such as the OWM, MPCA, and ERC can play an important role in providing opportunities for non-confrontational communication between industry, citizen groups, the public, and government agencies. Task forces have been established and can be expanded. Conferences, joint sponsorships of events, and other opportunities for dialogue and interaction have been and can continue to be developed. The MPCA and the metropolitan county small quantity generator compliance workshops help to inform the generating community about regulatory requirements. This understanding promotes prevention, and is an example of the type of activity which could be expanded so that all regulations and requirements are adequately explained to affected industries.

Industry can also be proactive by working with the public and with community groups throughout the toxic pollution prevention planning process and by understanding and responding to their concerns. In this manner, public review of progress reports in a strictly antagonistic setting can be avoided. Companies may benefit from better community relations as well as from ideas from residents near their facilities. A good example of collaboration between industry and community groups is the Citizens for a Better Environment's "good neighbor" program as discussed in the November 19, 1990 City Business (Jacobson, 1990). This program encourages dialogue between community groups and local industries. The state should support this type of activity and play a role in helping to facilitate cooperation in this area.

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III. ECONOMIC BARRIERS

A. INTRODUCTION: PROBLEM STATEMENT AND CONTEXT

1. BACKGROUND: ECONOMICS AND POLLUTION PREVENTION

Economic factors often work in favor of pollution prevention approaches. The benefits of such projects often include easily measurable factors such as greater operational and production efficiencies, increased product quality, reduced regulatory and waste management expenses, reduced long-term liabilities, and reduced raw material costs. Other benefits, such as increased employee morale or enhanced corporate reputation, are also important although more difficult to measure. Because of these benefits, pollution prevention is in many cases profitable. Facilities can achieve at least some direct return on their investment in contrast to pollution control approaches which typically only add to overall operational and production costs.

Although pollution prevention may be the best option for economic and environmental reasons, many companies nevertheless do not undertake pollution prevention programs. There is widespread belief that many pollution prevention opportunities are not being realized because of various barriers related to the way in which businesses make economic decisions.

Some of the barriers discussed in this chapter are not "economic" in the narrow sense, but are rooted in the way in which companies perform analyses and make economic decisions. This analysis of economic barriers closely relates with the chapters on institutional and educational barriers. Some of the barriers to be discussed in this chapter stem from long established attitudes about economic decision-making. These may include barriers such as resistance to alternative approaches largely because they are new and decision-making that does not extend beyond very short time horizons. Other barriers include failing to consider the less direct benefits of alternatives and decisions. In some cases, these barriers can reflect inappropriate economic signals or lack of access to resources. This chapter focuses on select barriers which impede companies from taking advantage of the benefits of pollution prevention.

Studies such as Economic Incentives for the Reduction of Hazardous Wastes (ICF Consulting Associates, 1985), Approaches to Source Reduction: Practical Guidance from Existing Policies and Programs (Environmental Defense Fund, 1986), and Motivating Industry toward Waste Minimization and Clean Technology (MacLean, 1989) have analyzed economic barriers to pollution prevention and pointed to solutions. These barriers are complex, since each facility faces a unique economic universe and because institutional factors can play such an important role in a company's activities. This chapter will pay particular attention to opportunities for pollution prevention which are cost effective and which are not being implemented because of barriers which arise from economic factors. This is an important focus for the powerful tools of public policy: facilitating the economic desirability of socially beneficial activity.

Finally, it is important to note that most of the economic barriers discussed in this chapter do not apply to the large number of pollution prevention opportunities that are

simple and inexpensive. Opportunities which cause little or no interruption in production, do not impact product quality or require significant capital resources fall in this category. The barriers discussed in this chapter apply primarily to those larger projects for which careful economic analysis is essential.

2. FACTORS INFLUENCING BUSINESS DECISION-MAKING

Like all organizations, companies are forced to set priorities for the use of limited financial and human resources. The decision to pursue pollution prevention has resource implications which may include: investment of money and resources, changes in pollution-related and other fees, shifts in waste management and pollution control expenses, changes in operational efficiency, profitability, product quality, and other impacts.

Companies generally perform economic analyses before making decisions about investment or operational changes. An economic analysis which is incomplete (e.g. neglects to include an accounting of indirect benefits or fails to accurately assign costs) may affect the likelihood of implementing specific pollution prevention projects. A comprehensive and inclusive economic evaluation of a situation resulting in the generation of pollution is an important and essential step in the implementation of pollution prevention applications.

When economic analyses suggest that pollution prevention projects are desirable companies still may be reluctant to move toward implementation out of fears regarding matters such as product changes or process interruption. One specific fear that is identified is lower consumer acceptance as a result of new processes or operations. In most instances, this fear is unfounded. For example, one Minnesota environmental consulting firm claims that a majority of preventive applications result in increased product quality and lower costs. Without doubt, pollution prevention has proven to be profitable for many companies. An important advantage of pollution prevention is that often higher quality products are produced.

Some labor groups and employees may have concerns about process changes as this relates to job loss and modifications to job tasks. Consumer expectations or demand for specifications can be the source of barriers to implementation of preventive options. These economic barriers will also be discussed below.

If thorough analyses are done and concerns about product quality are overcome, in some instances, economics may suggest that it does not make sense to undertake preventive applications because the activity does not appear to be profitable. Without external impetus (e.g., mandatory regulatory requirements) companies will not choose to implement specific projects for which the costs outweigh benefits. In some instances, this cost-benefit analysis may reflect economic signals (e.g., costs for raw materials, waste management or pollution control and regulatory compliance) that do not accurately incorporate all costs and benefits. This problem of "externalities" or costs borne by third parties may lead companies to reject options which are cost effective only if all true costs and benefits were to be included in an analysis.

Finally, situations may exist where companies evaluate prevention options and find them to be cost effective but lack financial and/or human resources to implement the options. Lack of resources poses a real barrier for some companies. Some pollution prevention projects require a degree of financial investment as well as time, information, and expertise.

The remainder of this chapter will provide an examination in greater detail of specific barriers and outline specific recommendations to address them.

B. ECONOMIC BARRIERS

1. INACCURATE MARKET SIGNALS

According to the study Serious Reduction of Hazardous Waste (U.S. Congress Office of Technology Assessment, 1986), the rising costs of waste management and its associated liabilities are primary considerations for companies initiating waste reduction. For many companies, however, costs of waste disposal or costs related to the release of pollutants are not significant. These costs are often a small portion of a company's total costs and potential cost savings may not justify a priority project to reduce them.

In some instances, the costs of releasing toxic substances may be less than the cost of implementing a pollution prevention project. For example, direct costs for stack and air releases (74 percent of total reported toxic chemical releases in Minnesota) may be minimal or non-existent. In many specific instances, facilities can release or dispose of toxic chemicals to air resources without costs associated with this action. If wastes or pollutants are cost-free or if costs are minimal, companies are not likely to modify operations. They may choose to defer investment of time and energy in changing operations or production processes.

Raw materials and hazardous substances that ultimately result in pollution are sold for prices which do not internalize the full cost to society. This issue of externalities is well-studied in economic theory and was the focus of a recent article in Building Economic Alternatives (Morris, 1990). Health or environmental damage which may be caused by substances are addressed through personal or public resources. The costs are often times spread throughout society and on to future generations. For many companies, fees which are assessed as a result of pollution-related activities may be insignificant to the extent that they do not fully serve as disincentives to activities generating the pollution. Public subsidy of waste management facilities may in some instances artificially reduce the cost of generating waste. Additionally, damage to human health and the environment may result from the use of relatively inexpensive chemicals. If the prices for such chemicals were to reflect the actual economic cost to society, preventive activities would be much more likely to balance out as a cost-effective action. However, assigning costs to the specific substance is difficult and complex.

Another way of assessing the impact of inaccurate market signals is to utilize full lifecycle costing in assessing the true economic impacts of products and processes. As noted in a recent report entitled A Technical Framework for Lifecycle Assessments (Society of

Environmental Toxicology and Chemistry, 1990), there is a growing movement toward the use of lifecycle assessments as an environmental and economic analysis tool. Lifecycle assessments aim to objectively determine the environmental impacts of a product, and include consideration of raw materials acquisition, manufacturing, waste management, and emissions among other factors. The use of analytic tools such as lifecycle assessments can be valuable in determining the overall economics of producing a certain product as well as the environmental effects. While prevention technologies often result in a higher quality product, one must consider that changes could produce a product which must be replaced more often or is less reliable. This could result in a net increase of pollution even if the process itself created less pollution per production unit. Full product lifecycle analysis must be performed in order to evaluate if less waste is indeed generated through the changed process.

There is increasing recognition of the costs imposed on society by generating toxics. Most of these costs are rapidly increasing. A 1989 survey of Minnesota hazardous waste generators highlights that over half of the large quantity generators indicated spending 5-25 percent more for waste management over the last three years. Almost 30 percent of the respondents reported increases of 25 percent or more. As the process of internalizing the external costs of environmental damage continues, costs associated with the release of toxic pollutants will continue to rise. This will make pollution prevention options more economically attractive. Public policy measures can help to assure that external costs are internalized and factored into economic decision-making.

2. INCOMPLETE COST/BENEFIT ANALYSIS

a. Failure to Consider Indirect Benefits

There are many benefits to pollution prevention which are relatively easy to measure. These include increased efficiency, reduced waste management and disposal costs, and increased product quality. Other benefits are more difficult to quantify. They are often overlooked:

- ▶ Pollution prevention may present opportunities to capitalize on environmentally responsible activities. Through effective marketing, companies can inform consumers about the advantages of the use and purchase of their products (e.g., green marketing). Environmental marketing will likely be a major issue and practice throughout the 1990s. In any case, good public relations often result. Commercial customers may prefer to do business with suppliers who take active steps to prevent pollution. In the future, customers may demand this of the companies with whom they do business.
- ▶ Investors and industry analysts react positively to companies with good environmental records. This demonstrates effective management and serves as an indicator for lower probability of major future environmental liabilities. Alternatively, companies which have poor environmental records often face negative reactions in the investor community. Increasing pressure to adhere to the

"Valdez Principles," which set objectives for environmentally sound corporate behavior, also may have a significant effect on investor and corporate behavior.

- ▶ Increased employee morale and pride can result from pollution prevention programs. Employees may feel that they are participating in a worthwhile effort and derive increased pride from working for a company which cares about the environment.
- ▶ An additional economic benefit which may not relate directly to the company is, of course, the benefit to the environment and to public welfare. This is difficult to quantify, but environmental concerns do have economic implications which can be considered in an analysis. Ethical behavior can arguably be considered to have economic benefits, although indirect. Simply doing pollution prevention because it is the proper course of action can result in unexpected benefits.
- ▶ One important advantage of pollution prevention is that it can lead to reduced liability and future risk for the company. This can be particularly significant for long-term risks related to hazardous waste disposal, potential Superfund cleanup costs, or victim compensation.

If indirect benefits are not considered in analyses, an analysis is incomplete and will not reflect the advantages of implementing preventive projects. Admittedly, it may be very difficult to quantify some of these benefits but each of these does have economic implications.

Taking full advantage of economic benefits depends on top management's awareness of the advantages of pollution prevention. For managers with a "traditional" mindset, these points are not considered. Paradoxically, by only considering the measurable, short-term bottom line, the overall bottom line can be reduced. The process through which managers start to look at these more subtle but important factors is an evolutionary one. Management that is isolated from consideration of these factors will not likely include them at decision-making time.

b. Inaccurate or Incomplete Cost Accounting

Appropriate evaluation of preventive projects is dependent upon careful and accurate allocation of costs and benefits. If the costs of waste management, regulatory costs and other costs are related to a particular production process, but are allocated to a general category such as "overhead" or utilities, benefits of pollution prevention may not be accurately reflected. Sub-accounts may not exist which are specific to waste management or pollution costs. To the extent that these costs are not properly integrated when analyses are performed, profitability and cost estimates will provide a misleading picture of the desirability of preventive options under consideration. Costs which are saved through preventive applications may be invisible and any cost savings may not be considered in investment decisions.

Another manifestation of incomplete cost accounting is assignment of profit targets based upon particular allocations of variable and fixed costs. If preventive options result in a proportional change in assignment of costs (e.g. higher percentage to overhead or equipment), they may appear to be less profitable from a traditional accounting perspective and consequently less desirable.

Companies that attempt to integrate waste costs with operational or production costs may have difficulties accurately doing so. This barrier is discussed in "Overcoming Impediments to Waste Minimization" (Smith, 1990). Identifying waste costs is less complicated for large, single-product plants, whereas smaller, multi-product facilities find greater difficulties with this task. Many costs and benefits associated with pollution are hidden and difficult to identify. For example, regulatory fees, liability issues, maintenance costs, environmental staff costs, health issues, and corporate reputation may impose difficulties in cost assessment. In other instances, costs may be allocated to various divisional financial statements and may be difficult to extract and analyze. There may also be complications from understanding the implications of combining production lines, changing materials or equipment. Needed information from suppliers and vendors may also be difficult to obtain. Complete cost-benefit analyses require calculations of costs that may be difficult to obtain.

Failure to take into consideration all relevant costs and benefits or failure to properly allocate these costs to appropriate operations and processes may present unnecessary barriers to pollution prevention.

3. INAPPROPRIATELY SHORT TIME HORIZONS

Short-term economic goals are very pervasive in American industry. This short-term perspective may be driven by such factors as cash flow pressures, executive bonus systems, stockholder expectations of high dividends and takeover fears. Companies with very short-term perspectives on criteria for investment (e.g. 1-2 year payback periods) may be less likely to support certain prevention projects despite the fact that they would be economically viable in a moderate payback timeframe. If management forces environment-oriented investment to jump the same financial hurdles as other investment, pollution prevention activities may not receive adequate funding. This particular barrier does not apply to projects which do offer rapid payback potential.

If corporations have only tentative commitments to continue producing certain products or to maintain specific production facilities, management decisions may defer investments which may not pay back over the long-term. In these instances, firms may minimize investment altogether with the expectation that closure or product discontinuation may result shortly. Even needed repairs may be delayed and attention to the operations lessened. Alternatively, rapid changeover in product lines or production processes does offer an opportunity for prevention options to be considered as the new products or processes are under evaluation. In cases where product and process turnover are rapid and frequent it is important that pollution prevention concepts be introduced into the facility's research and development activities.

4. FEAR OF MARKET SHARE LOSS/CONSUMER PRESSURE

Results of the Minnesota Plan of Action (Haines, 1989) survey identify the most significant barrier to waste reduction (as reported by industrial generators of hazardous waste) to be reluctance to tamper with proven processes for fear of adverse effects on product quality. As previously noted however, pollution prevention projects often result in increased quality. Ultimately, quality reflects what customers require and expect. By failing to meet customer expectations, companies may fear that sales will suffer. Fears of lower quality are strongly connected therefore to concerns about lower sales and profits.

There may be cases where customers demand an item which inherently causes pollution through its manufacture. The perceived desirability of the product may be linked to the necessity for a polluting process (e.g. high gloss autos or appliances that resist rust when scratched or bleached paper products). Non-polluting or less-polluting substitutions for these products may not be as acceptable to consumers. Therefore, companies may see a significant risk in changing to a non-polluting process or product.

It is important to note that there are many prevention options that cause no noticeable change in product characteristics or that increase product quality. Additionally, there is considerable consumer interest in low-impact products. With intelligent marketing efforts, companies may find a potential and profitable niche. Special marketing efforts may be necessary because consumers generally do not have sufficient information available to choose products which have been produced through less polluting processes. Labels rarely allude to production processes, and other sources of information on this may be lacking. Therefore, even consumers who are concerned about environmental issues may be unable to choose a product produced through cleaner technology. Similarly, consumers are generally not informed as to the toxic ingredients and components in many of the products that they purchase. The uninformed consumer population poses a barrier in that they may continue to unknowingly "demand" products which are more dependent on polluting processes or toxic ingredients. Some of this demand may be artificially created through advertising.

Sometimes it is consumers who are prevented from purchasing products with reduced environmental impact. That is, even if consumers are informed about the negative environmental implications of a certain product, they may not be able to translate their desires into purchase decisions in the marketplace because other options simply may be unavailable. This lack of other options also can pose a barrier to consumers exerting pressure for products produced in a less polluting manner.

5. INAPPROPRIATE PRODUCT/PROCESS SPECIFICATIONS

Very specific cases involving the barrier "fear of customer loss" result from unnecessarily rigid specifications for products or processes. This poses a barrier to pollution prevention. The report Reducing Hazardous Waste Generation (National Research Council, 1985) discusses product quality standards as an important factor in industrial decisions about waste generation. The report suggests that opportunities for additional waste reduction may lie in relaxation of specifications on a case-by-case basis.

Specifications which require polluting processes pose problems for the defense industry, the building industry, and for industries closely regulated by government agencies. For example, very specific solvents (e.g., chlorinated solvents) may be required that result in pollution.

6. FEAR OF PRODUCTION INTERRUPTION

If prevention options require major operational changes, equipment alterations or process modifications, companies may resist implementation because of concern about not being able to produce the product at all or having higher reject rates through less reliable actions. Some of the issues surrounding this barrier are discussed in EPA's Waste Minimization Opportunity Assessment Manual (EPA, 1988). Companies are concerned about possible losses in productivity. This includes concerns regarding the need for increased maintenance or quality control, and increases in downtime. Adding pollution control devices to the end of the pipe is perceived as an action involving lower economic risk.

7. LIMITED ACCESS TO NECESSARY RESOURCES

a. Internal Resources

Pollution prevention projects which require capital investment will likely face competition from other needed capital projects (e.g., automation and plant expansions). In some cases, pollution prevention may be included as an aspect of another project. However, prevention projects can face stiff competition for limited internal capital resources. Presumably, if appropriate cost accounting has been performed, this impediment to implementation would simply deter pollution prevention projects offering a lower rate of return relative to other uses of funds. Under this scenario, competition would not prevent implementation of simple, low cost, high-return projects.

The shortage of staff resources also presents a significant barrier to pollution prevention. Many companies operate with lean staffs of trained employees who are faced with more demands than time allows. In addition, there is pressure to further reduce headcount, especially in periods of economic downturn or stagnation. Some pollution prevention projects require time-consuming or expensive testing, research, and investigation. Employee time and resources for outside consulting may be unavailable to address this need.

b. Lack of Access to External Capital

Small businesses, start-up companies, or corporations with high debt loads may have a difficult time obtaining bank loans for pollution prevention purposes. Financing from government grants or loans is also likely to be unavailable. The study Incentives and Barriers to Commercializing Environmental Technologies (National Environmental Technology Applications Corporation, 1990) prepared for EPA's Office of Research and Development identifies some of the issues surrounding access to financing from various types of investors.

If a company is currently unprofitable or only marginally profitable, funding may also be unavailable for pollution prevention efforts. Capital expenditures may be particularly vulnerable if the company is feeling economic pressure.

Needed investments in pollution control equipment or other expenses to assure compliance with pollution control regulations such as permitting costs, also compete with potential investments for prevention applications. Management may be reluctant to expand environmental investment for pollution prevention if extensive investment for pollution control has already been made and if more will be needed in the future. Compliance with existing environmental regulations may be viewed as having higher priority than process modifications that may result in preventing waste.

Barriers do differ between existing and new systems. Existing systems face limitations of physical space and existing capital investment. New systems may more easily allow the inclusion of a pollution prevention approach.

8. WORKER FEAR OF JOB LOSS

If employees or labor groups look upon pollution prevention as a threat to their jobs, these concerns may pose a barrier to pollution prevention efforts. Experience shows that companies with pollution prevention programs are often strengthened economically and produce higher quality products in a more efficient manner. The net result can be the creation of new job opportunities. Pollution prevention programs that are successful in reducing the use of toxic chemicals have the additional advantage of reducing the risk of worker exposure to potentially harmful substances. Existing evidence in Minnesota does not indicate significant worker and labor opposition or concern specific to pollution prevention. However, these groups are sensitive to possibilities of job dislocation resulting from any source, including environmental programs.

Worker and labor concerns are important and deserve consideration. Successful pollution prevention programs depend upon active employee participation. Production workers in particular have an intimate knowledge of production processes and how these may be improved. Labor groups can potentially organize to oppose environmental programs if they fear that these could result in job loss for their members. Therefore, any policies which affect the workplace must remain sensitive to their implications for employees.

C. RECOMMENDATIONS

1. OWM SHOULD EXPLORE WAYS TO INTERNALIZE EXTERNAL COSTS TO ASSURE APPROPRIATE MARKET SIGNALS

The economic signals that decision-makers react to are among the most powerful determinants of choice regarding raw materials, product mix, and production process specifications. Often these signals do not reflect the true cost to society regarding the generation of pollution.

Specific proposals to assure the internalization of full costs and benefits are beyond the scope of this report. However, this issue should be further studied and relevant costs monitored. This issue should be examined again in the OWM's first Pollution Prevention Evaluation Report (required by the act) to be presented to the legislature in December, 1992. Specifically, two issues should be examined:

a. Study the Introduction of a Front-End Tax or Fee on Hazardous Chemicals

Taxes and fees as economic tools have been examined in several reports such as Industrial Waste Reduction: State Policy Options (Thomas, D., 1990), Economic Incentives for the Reduction of Hazardous Wastes (ICF Consulting Associates, 1985), and Approaches to Source Reduction: Practical Guidance from Existing Policies and Programs (Environmental Defense Fund, 1986). The term "tax" is used in this discussion to refer to a levy which has the purpose of providing general revenues to the state. The term "fee" refers to a levy which is designated for the support of specific programs aimed at those individuals or facilities paying fees.

Options include front-end taxes or fees (e.g. feedstock materials), waste-end taxes or fees (e.g. quantity of waste generated), or excise taxes or fees (e.g. consumer products that pollute). Taxes or fees can change the relative costs of various options as well as the purchasing patterns of the consumer. Taxes and fees can also help to internalize some of the costs associated with the use or release of certain materials.

Advantages of front-end taxes or fees include the focus of attention on the use of particular chemicals and increased emphasis on looking "up-the-pipe" at the beginning of the process to promote pollution prevention. Front-end taxes or fees have the potential to be more equitable in their application. Specifically, front-end fees generally would apply to a large population of affected parties. In addition, front-end taxes or fees offer a stable revenue source for funding pollution prevention programs.

The Minnesota Governor's Select Committee on Packaging and the Environment (SCOPE) in its December 18, 1990 final report (Governor's Select Committee on Packaging and the Environment, 1990) has recommended a fee system based in part on a front-end fee. This fee would apply to manufactured products intended for ultimate use or consumption in Minnesota. If signed into law, this fee would offer an incentive to manufacturers and consumers to reduce the amount of hazardous components in packaging they produce or purchase by adding additional costs. The fee would help to internalize some of the costs which the uses of these materials impose on the public and the environment.

Similarly, it is recommended that a per pound fee on toxic chemicals (TRI chemicals) produced, purchased or imported by Minnesota industry be considered. Such a fee would serve as a disincentive for using these materials and could be used for providing support for pollution prevention activities which focus on alternatives to the use and release of such materials. This fee should be studied in conjunction with similar fees already in existence.

b. Consider Expanding the Current Pollution Prevention Fee

The effectiveness of the current pollution prevention fee in reducing wastes and toxic chemical releases will be analyzed in the OWM's Pollution Prevention Evaluation Report (December, 1992). Issues to be studied should include the imposition of a graduated increase in the fee over time, consideration of expanding the universe of facilities required to pay fees, and consideration of setting different levels of fees for different environmental media.

2. THE LEGISLATURE SHOULD REMOVE THE \$30,000 CAP ON THE POLLUTION PREVENTION FEE

At present, facilities are not required to pay the \$0.02 per pound fee for toxic chemical releases of over 1.5 million pounds annually. This cap of \$30,000 allows facilities to release toxic chemicals above the 1.5 million pound threshold without charge. It can be viewed as encouraging these releases since they are exempt from the fee. It is recommended that facilities be required to pay the pollution prevention fee for all quantities of toxic chemicals reported released.

3. OWM SHOULD EXPAND TECHNICAL ASSISTANCE TO ALLOW FOR AN INCREASED EMPHASIS ON APPROPRIATE ECONOMIC ANALYSIS IN ASSESSING POLLUTION PREVENTION OPTIONS

Technical assistance programs are one potentially productive avenue for providing companies with information on complete and accurate cost accounting methodologies. While technical assistance is usually thought of in terms of engineering or technology, the existence of unnecessary economic barriers to the implementation of projects may require an expansion of its tools and expertise to include accounting and cost-benefit principles. The OWM will assess appropriate ways to address this need through its technical assistance efforts.

4. OWM SHOULD WORK WITH EDUCATIONAL INSTITUTIONS AND OTHERS TO EXPAND THE TRAINING OF BUSINESS DECISION-MAKERS TO INCLUDE CONSIDERATION OF THE FULL COSTS AND BENEFITS OF ENVIRONMENTAL DECISIONS

While this issue is addressed in the Educational Barriers chapter, it is worth noting that further opportunity exists to train personnel in performing economic analyses that are inclusive of environmental costs. Work is needed to increase overall sensitization to environmental issues. Consideration should be given by educational institutions to further integrate environmental considerations into coursework.

Recently, some materials have been developed to assist companies in addressing the economics of waste generation. One example is General Electric's software and training materials entitled, Financial Analysis of Waste Management Alternatives (General Electric, 1987). This and others which could be developed would be useful in helping personnel better perform full-cost accounting efforts.

The OWM, in cooperation with others, will consider sponsorship of workshops to assist company personnel in understanding the positive economic opportunities of pollution prevention and other environmental actions.

5. OWM SHOULD CONTINUE TO EVALUATE THE EFFECTIVENESS OF ITS FINANCIAL ASSISTANCE PROGRAMS FOR POLLUTION PREVENTION

At the present time, Minnesota statute authorizes the administration of a pollution prevention grant program to financially assist research and development efforts in the pollution prevention field. These feasibility study grants address some of the barriers discussed in this chapter. For those companies who receive such a grant, this funding may provide the scarce resources necessary to test a new process. Successful grant projects can then be used to promote usable technologies to those facilities that fear product or process disruption. Projects are designed to serve as demonstrations which can reduce levels of concern among other potential users of such a technology. In general, the grant program provides evidence of a state commitment to investment in pollution prevention approaches as well as to a cooperative effort based on partnership rather than mandates. For a relatively small public expenditure, an elevated focus can be drawn to pollution prevention.

The effectiveness of these grants should be continually reviewed and will be discussed in the OWM's Pollution Prevention Evaluation Report. In addition, other types of financial assistance should be further explored in this report.

6. OWM SHOULD EVALUATE THE MERITS OF CREATING POLLUTION PREVENTION PROGRAMS DIRECTED AT CONSUMERS

Although the environmentally responsible consumer movement is still in its infancy, it will likely continue to gather more focus in the future. This widely held view was expressed recently in "Going for the Green," an article in Environmental Action (Editors, Environmental Action, 1990). This article contained a recent report which found that 23 percent of all American households could be considered "green." Some states have passed laws which set standards for the uses of certain claims on packaging and efforts at the federal level have also begun.

Even Forbes recently issued an advertising supplement entitled Protecting Our Environment: The Business Solution (Thomas, L., 1990) in which Lee Thomas, former EPA Administrator, recognized the significance of the environmental consumer market force and warned corporate America to "continue to change its thinking at the highest levels" at the risk of feeling pressure from and losing support of consumers and stockholders.

The SCOPE report cited earlier calls for a report on progress towards a uniform, national system for accurate environmental labeling by July 1, 1992 by its proposed Packaging Advisory Council. SCOPE recommends consideration of state voluntary or mandatory standards for labeling if an effective national program is not in existence or scheduled for implementation by that date. It is recommended that future environmental

labeling recommendations in Minnesota consider inclusion of labeling relevant to pollution prevention efforts. Consumers could be informed about toxic ingredients in the products which they buy, or about specific processes which are polluting and which are involved in producing consumer products.

Consideration should also be given to developing programs which could provide additional information to consumers about the products or services which they purchase. California's Proposition 65 has set up mechanisms for informing the public about toxics in products through point of purchase materials, for example. Information could also be provided on fact sheets or in educational materials. Further education can facilitate the public in exerting marketplace pressure on facilities to adopt cleaner production processes. An educated public also can better reward those companies which have made progress in preventing pollution.

7. BUSINESSES SHOULD INSTITUTE WORKER RETRAINING PROGRAMS IN INSTANCES WHERE POLLUTION PREVENTION ACTIVITIES MAY AFFECT WORKERS

The general worker dislocation problem in Minnesota has been recently analyzed in A Survey of Dislocated Workers in Minnesota (Minnesota Department of Jobs and Training, 1989). This report analyzes and projects numbers of dislocated workers in the state.

Some programs are available for Minnesota dislocated workers. The Minnesota Department of Jobs and Training provides services which are funded through the Economic Dislocation and Worker Adjustment Assistance Act. Minnesota Statutes, Chapter 282, Article 2 provides for supplemental funds for employment and training assistance to dislocated workers and provides for pre-feasibility studies. The Trade Adjustment Assistance Act provides employment and training services to workers who have been displaced due to foreign trade. The recently signed federal Clean Air Act (CAA) also provides for a \$250 million, five-year program of training and weekly benefit payments for workers terminated or laid off as a consequence of the CAA. Environmental and labor groups advocate a Superfund for Workers which goes beyond these programs in terms of providing extensive educational and severance benefits.

Companies should strongly consider retraining any employees who might be dislocated as a result of pollution prevention and should promote existing retraining programs. Sensitivity to labor and retraining should be incorporated into plans which involve changes in employee assignments. Educating employees about the benefits and positive aspects of pollution prevention is also important.

8. OWM, IN COOPERATION WITH OTHER STATE AGENCIES, SHOULD REVIEW GOVERNMENT PROCUREMENT PRACTICES AND SPECIFICATIONS TO PROMOTE ADOPTION OF POLLUTION PREVENTION PRACTICES

This issue is more fully discussed in the Government as a Role Model chapter but it is worthy of mention in this chapter as well. Government agencies have considerable power to require the use of certain materials or practices in the manufacture of materials which they purchase. Government should consider studying current specifications with the goal of identifying opportunities for encouraging pollution prevention. This could result in discontinuing requirements to use polluting processes or materials. It also might extend to actively requiring the use of particularly clean processes or materials.

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IV. EDUCATIONAL BARRIERS

A. INTRODUCTION: PROBLEM STATEMENT AND CONTEXT

1. EDUCATION FOR POLLUTION PREVENTION: SCOPE OF CHAPTER

The Minnesota Toxic Pollution Prevention Act requires that this report examine educational barriers to pollution prevention and recommend strategies to overcome these barriers. Education for pollution prevention can occur in widely diverse settings and institutional contexts, including both formal educational institutions and informal on the job or in-service training opportunities. This chapter does not evaluate barriers and recommend strategies for all possible educational contexts. Rather, this chapter focuses on formal post-secondary education, and particularly on current training efforts for individuals who are likely to become business decision-makers, financial analysts, scientists, and engineers.

There are several reasons for this focus. Limited research and analysis on pollution prevention education suggests that post-secondary institutions can offer avenues for progress.. The training of individuals entering the industrial work force provides a leverage point and opportunities to widely influence decision-making within organizations that must address pollution issues. There is little doubt that further research and activities will be needed to explore possibilities in other areas. These areas include community education, elementary and secondary education, in-service or on-the-job training, and the role of mass media. Some of these issues, particularly those related to the need for an environmentally literate population are being addressed through other state programs. Issues related to ongoing training opportunities after formal education that are aimed at business decision-makers will be addressed in the institutional and economic barriers chapters of this report.

2. NEED FOR POLLUTION PREVENTION EDUCATION

United States Environmental Protection Agency (EPA) Administrator William K. Reilly has described pollution prevention as the "quiet revolution" that will create both a healthy environment and a sustainable economy. But the question remains whether industry is intellectually prepared to implement the new doctrine. Does top management understand the connection between quality, efficiency, and environmental protection? Do accountants realize the importance of full cost accounting for future reduced disposal costs, reduced liability, and reduced raw material consumption? Are engineers fully prepared to implement process modifications, feedstock substitutions and inventory controls? Both industry and educational representatives say "no."

The business community has identified lack of information and inadequate educational training of new employees as a barrier to pollution prevention. This claim has been made informally through interviews and forums, such as the Pollution Prevention Task Force, and has been documented by several reports.

Industry members of the Minnesota Pollution Prevention Task Force note that business wants, and needs, pollution prevention specialists (PPTF, 1990). In a recent discussion,

task force members focused attention on educational institutions, saying that colleges and universities are not producing graduates who understand pollution prevention. Before entering the work place, chemical engineers and environmental specialists must have instruction in industrial operations and pollution prevention. In addition, business administrators and accountants must be prepared to support environmental protection through corporate policy and full-cost accounting for pollution prevention. Business students must learn that reducing waste is part of the key to overall quality. Task force members concluded that if environmental employment needs are to be met, we must achieve a merger of academia and the business world.

A report sponsored by the Corporate Conservation Council (CCC) of the National Wildlife Federation has expanded on this theme of lack of information (Buchholz et. al., 1990). The CCC has observed that despite the increasing importance of environmental issues in finance, marketing, operations, and strategic management, business schools devote minimal attention to the interaction of business and the environment. This lack of education raises the concern that new employees may be more likely to make fundamental mistakes that increase environmental liabilities. They may also be unable to recognize environmental protection as an opportunity to incur cost savings and make money. The CCC report concludes that this education gap impedes the resolution of business and environmental conflicts and blocks achievement of economic growth in concert with environmental protection.

Educational representatives have also picked up the call for integrating environmental protection, specifically pollution prevention, into the curriculum. For example, the engineering field has been particularly self-critical of its traditional neglect of environmental management. Professor David Allen, University of California at Los Angeles (UCLA), states "...there is currently very little emphasis placed on environmental impact and pollution prevention concepts in most engineering and science curricula" (Allen, 1990). He notes that for the past several decades, environmental concerns have played a secondary role to product and process function.

In a recent article on future challenges in engineering (Editors, Civil Engineering, 1990) many references were made to the gap between industry need and the current educational system. Professor David Marks, Massachusetts Institute of Technology (MIT), said the curriculum must make room for advanced technical education required for interdisciplinary tasks such as environmental cleanup. In the same article, a practicing engineer called for engineers to lead people to a proactive approach that would encourage "waste minimization, recycling, and strict environmental standards." Another consulting engineer restated the importance of hazardous waste issues, concluding "The traditional curriculum will not suffice."

Professor Marvin Fleischman has made perhaps one of the strongest statements of the problem (Fleischman, 1990): "despite the apparent job opportunities for chemical engineers in for example environmental engineering, these areas still seem to be largely ignored in the curriculum...It is therefore timely and perhaps mandatory that greater emphasis be given in the chemical engineering curriculum to topics such as waste reduction, safety, and health."

Clearly, both industry and academia recognize inadequacies in information transfer and education which prevent effective utilization of pollution prevention in environmental management. There is also wide-spread consensus that integration of pollution prevention into business as usual will require, among other things, increased education, public support, and information transfer (ASIWPCA, 1990). The question for this chapter is how will that happen in Minnesota? This question will be addressed by examining some of the barriers to pollution prevention education, and by recommending a course of action.

B. BARRIERS TO POLLUTION PREVENTION EDUCATION

The critical players in industry who institutionalize pollution prevention are those close to the waste generating activities and those who make decisions to support preventive projects. These individuals are environmental specialists, process and chemical engineers, production technicians, managers, accountants, and market analysts. Their willingness and ability to implement pollution prevention can be significantly influenced by the educational training they receive. Typically, these individuals are trained at or are enrolled in programs at colleges, universities, and vocational colleges. The following section examines the major barriers to pollution prevention instruction that occur at some of these educational institutions.

1. LACK OF TOP LEVEL SUPPORT

Leadership at educational institutions--presidents, deans, department chairs--set overall priorities for instruction and research. These priorities can serve as a barrier to pollution prevention education by either excluding it or conflicting with it. It is common for educational leaders to simply exclude pollution prevention and environmental protection from institutional priorities. This benign neglect expresses a clear message--if you want to serve your institution and gain recognition, pollution prevention is not a primary area of focus.

Less benign is the leadership that establishes conflicting priorities. For instance, if a college or university department determines that its professors should strive for large research grants from the National Science Foundation (NSF), pollution prevention studies will be in conflict with this goal. NSF doesn't fund applied work such as pollution prevention research; and professors who are busy writing and implementing NSF grants will not have the spare time to develop pollution prevention coursework or research.

2. INSUFFICIENT FACULTY MOTIVATION AND TRAINING

One of the profound barriers to integrating pollution prevention into the curriculum is faculty motivation and interest. It is difficult to create new courses or incorporate new material into existing curriculum. Until recently, few teaching aids (e.g., case studies or textbooks addressing pollution prevention) existed. In addition, many faculty lack the knowledge and interest to infuse safety, health, and environmental protection into their classes.

Another problem for faculty is research pressures. Today, faculty are under more pressure than ever to secure large grants and get published. When presented a choice between writing a new curriculum to incorporate pollution prevention or writing a grant proposal, most faculty will choose the latter.

Even if curricular materials were available, many faculty do not have the educational background to make use of it. There are very few incentives or support and development activities to encourage faculty to make progress in this area. Unless faculty receive training and the environment becomes a competitive field in which to receive grant money and get published, it is not likely that instructors will pay much attention to the subject.

3. INSUFFICIENT STUDENT INTEREST

Educational barriers to pollution prevention also include those which are primarily attitudinal in nature. For example, engineering students do not consider pollution prevention to be "mainline" engineering. Their demand for this content area is modest as a result. This problem is especially prominent in business programs. Student demand for treatment of environmental issues has been small, possibly because students haven't yet seen a connection between job success and environmental expertise.

4. INFLEXIBLE CURRICULUM REQUIREMENTS

At most educational institutions the degree coursework is already crowded with requirements and continually faces new demands to add more credits and topics. In many instances, there is simply little or no room to add pollution prevention into the program. For example, at the University of Minnesota, 200 credits are required for graduation. This credit requirement fills and often overflows a four-year program. Only 16 credits are elective, making it difficult to require additional stand-alone courses in environmental protection or pollution prevention.

Even if educational institutions were willing to change requirements to accommodate pollution prevention instruction, accreditation demands may stand in the way. For instance, engineering instructors have cited American Board of Engineering Technology (ABET) accreditation requirements as a barrier to including pollution prevention in the undergraduate curriculum.

5. LACK OF INSTRUCTIONAL MATERIALS

Many faculty lack the preparation to teach in the area of pollution prevention and environmental protection. There is not sufficient existing material (e.g., casebooks, text books or videos) that is easily available to integrate into existing classes.

C. RECOMMENDATIONS

1. EDUCATIONAL INSTITUTIONS SHOULD PROVIDE STRONG TOP-LEVEL SUPPORT FOR POLLUTION PREVENTION EDUCATION

At educational institutions, as in business, top level support is crucial to effectively address pollution prevention. Changing curricula to include environmental protection means working a proposal up through layers of administration fraught with academic politics. This pathway is much smoother and faster with a mandate from the top--from the president, deans, or department chairs.

This support should be made concrete by creating an environmental policy for the institution that calls for instituting a pollution prevention program, and integrating environmental protection throughout the curriculum.

2. EDUCATIONAL INSTITUTIONS SHOULD ACT AS ROLE MODELS BY ADOPTING POLLUTION PREVENTION PROGRAMS

Educational institutions produce a wide range of wastes: hazardous and nonhazardous wastes from labs and maintenance operations, medical wastes, and solid wastes from offices and cafeterias. Like businesses, colleges could benefit their bottom line and the environment by adopting pollution prevention programs. By serving as examples colleges have tremendous potential to influence large numbers of students in the concept and practice of preventing pollution. The college committee of the 1990 Minnesota State Environmental Education Conference supported this idea and passed a resolution calling for post-secondary institutions to become environmental role models.

Several schools throughout the country have taken on this initiative. EPA's Pollution Prevention Division has funded a pilot project on minimizing wastes at Tufts University. Reportedly, this effort has communicated valuable concepts to students. The state of California college system has also begun a pilot waste audit program for its colleges. On a smaller scale, instruction by example occurs at the University of Minnesota in Professor Alon McCormick's chemical engineering labs. Labs have been re-designed to reduce waste through use of feedstock substitutions and process modifications. Labs are an excellent place for students to learn by doing. All labs should incorporate preventive applications.

OWM should work with others in developing programs and approaches to provide assistance to educational institutions for implementing pollution prevention programs. Such assistance could include a guidance manual for pollution prevention in educational settings.

3. EDUCATIONAL INSTITUTIONS SHOULD MODIFY CURRICULAR STRUCTURES AND REQUIREMENTS AS APPROPRIATE TO ENCOURAGE POLLUTION PREVENTION EDUCATION

a. Promoting Environmental Literacy in Lower Level Courses

Educational institutions should promote environmental literacy by infusing environmental concepts throughout lower level required courses.

Professors David Allen, Marvin Fleischman, and Alfred Marcus (Forum, 1990) have identified lack of environmental literacy as a barrier to teaching environmental protection at the college level. Students lack basic knowledge of why we need to protect the environment and how it is threatened. To address this gap, colleges may infuse environmental protection across the curriculum. The ideal place to accomplish this is in required courses in physical sciences, life sciences, social sciences, and humanities during freshman and sophomore years. The vision at UCLA is to develop freshman level courses that satisfy physical science requirements and cover basic environmental literacy. Despite being a challenging task, the strategy holds the potential of being very effective and having a significant long-term impact.

b. Offer Cross-Disciplinary Programs

Educational institutions should offer cross-disciplinary programs that address the needs of pollution prevention specialists.

Environmental specialists draw on a wide range of skills, including chemistry, engineering, economics, law and toxicology. This cross-disciplinary approach frustrates traditional departments in terms of training specialists. Recognizing this conflict, some colleges have chosen to create new programs. Again, UCLA serves as an example. UCLA offers a graduate program in environmental sciences and engineering. After three to four years of coursework in engineering, ecology, law, and public policy, a Ph.D. is awarded. This non-traditional degree was very difficult to institute at UCLA. However, the benefits are significant: the program addresses a real need for specialists, provides an in-depth focus, and creates visibility for environmental protection.

Professor Alfred Marcus, University of Minnesota, (Forum, 1990) advocates an interdisciplinary curriculum for business students that draws on contributions from engineering, natural sciences, public health, public policy, law, and other relevant fields.

c. Offer Specialized Courses That Address Prevention

Educational institutions should offer specialized courses that address pollution prevention, among other topics in environmental protection.

New courses in environmental protection have been developed within chemical engineering departments at UCLA, the University of Kentucky, and University of

Minnesota-Duluth. The advantage of these courses is their in-depth focus and visibility. Their drawback, as with all new courses, is that they may take a long time to implement.

The University of Minnesota-Duluth's chemical engineering program serves as a model where specialized courses have been required. All chemical engineers are required to take a four-course sequence that emphasizes environmental management. Waste reduction is a part of this coursework.

Through support from the National Wildlife Foundations's Corporate Conservation Council, specialized courses on business and the environment (including coverage of pollution prevention) have been developed and offered at several colleges and universities. These pilot courses were offered as electives, and taught at both MBA and undergraduate levels. The courses received high evaluations, but tended to attract only highly motivated students and consequently had modest enrollments. An alternative to offering such a course as an elective would be to require it, or make it part of a distribution requirement.

Opponents of required courses say they add an extra burden to an already over-loaded curriculum, and are too narrowly focused. Proponents say the curriculum should be changed to accommodate new areas. Elective courses are criticized for being just that--electives. It is thought that only the highly motivated students would enroll in them. An intermediate alternative to required and elective courses is to place specialized courses in an area of emphasis. For example, a chemical engineering student at the University of Minnesota-Twin Cities campus has only 16 elective credits, but 32 that can be taken for an emphasis. If the department creates an emphasis in environmental protection, new courses could easily be taken by students.

4. EDUCATIONAL INSTITUTIONS, INDUSTRY, AND GOVERNMENT SHOULD FUND THE DEVELOPMENT OF CURRICULAR MATERIALS

OWM should offer grants for curriculum development to include case studies, course outlines and other educational materials. These efforts should include approaches which would integrate pollution prevention into standard textbooks. EPA is currently funding development of materials for chemical engineering classes and Minnesota should take advantage of this national effort. In addition, OWM should coordinate curriculum development between industry, associations, and vocational colleges. Vocational college staff need advice in revising curricula and industry representatives and government agency staff should lend their expertise to the colleges.

The National Wildlife Federation's Corporate Conservation Council (CCC) is an excellent example of private-public cooperation. The CCC recognized that business students must understand how environmental issues are an integral part of business operations. In 1988 the CCC, whose membership includes federation leadership and senior executives from 16 major corporations, invited interested business schools to participate in a council-funded pilot project to infuse environmental issues into the business curriculum. Three schools responded: the University of Minnesota's Carlson School of Management, Loyola University of New Orleans, and the Boston University

School of Management. The three-year pilot project has included development of case studies, seven different course outlines, a bibliography, and specialized courses. The efforts of the CCC and these schools, among others, provide a vision of how to bring the environment to the business curriculum.

5. SPECIAL TEACHING TOOLS SHOULD BE DEVELOPED AND UTILIZED AS APPROPRIATE

a. Case Studies Are Needed

The American Institute of Pollution Prevention (AIPP) Education Council is producing a workbook of engineering problems based on pollution prevention case studies (Allen, 1990). These problems are being designed to complement standard engineering topics such as fluid mechanics, heat transfer, mass transfer, separation processes, chemical kinetics, reactor design, and chemical process design. The problems demonstrate both pollution prevention and fundamental principles normally covered in the engineering curriculum. They are therefore easily incorporated into existing courses. The workbook will be published as a two-volume set (problems and teacher's guide) in the fall of 1991.

Case studies and homework modules are being used at the University of Kentucky and UCLA (development supported by an EPA grant). This strategy is easy to implement, and can be broadly transferred between universities. The drawback is that it can only provide cursory treatment of environmental protection.

In the business field, the National Wildlife Federation's CCC is now developing a casebook with a variety of environmental and business teaching materials (Buchholz et al., 1990). This casebook could be used for stand-alone environmental business courses or as a supplementary text in standard business classes. One hundred percent of business faculty surveyed by the NWF said that case studies were the best format for instructing on environmental issues and business. The casebook will be available in late 1991.

b. Field Trips Needed

Students could be brought into facilities to observe pollution prevention projects in action. The potential for students to learn is great through direct, on-site visualization of pollution prevention. OWM should work with others to promote field trips for students.

c. Expand Internship Opportunities

OWM should examine ways to expand internship opportunities. Possible additional sources of funding should include matching grants from colleges and universities or cultivation of industry sponsors on the part of placement office activities.

MnTAP currently sponsors a very successful intern program. This could be expanded through matching funds from the University of Minnesota and industry. The likelihood of placement of interns in government would be enhanced if required internships

contained specified requirements which could be used by agencies in selecting and assessing internships.

d. Guest Lecturers Should be Cultivated

Guest lecturers from industry, government, and the environmental community should be used to infuse pollution prevention into the core curriculum.

This tool is especially pertinent to the business field. Business professors often lack the training and confidence to address environmental issues. This teaching barrier could be overcome with the use of guest lecturers from other departments (e.g. engineering, natural sciences and law) or from industry and government.

6. FACILITATE STAFF DEVELOPMENT AND RESEARCH

a. Instructor Training is Needed

Educational institutions, state government, and industry should cooperate in offering training for instructors in teaching pollution prevention.

Faculty interest and motivation is a key element to pollution prevention education. This factor can be enhanced through pollution prevention training opportunities. For instance, the National Science Foundation (NSF) recently sponsored a two-week workshop for faculty in engineering safety and health. A similar workshop focused on pollution prevention has potential.

In the business area as well, faculty may lack the background, time, and motivation to address environmental issues in their courses. This barrier could be overcome through special workshops, offered by business groups or universities, to educate and train faculty. Professor Anthony Cortese coordinated such a workshop at Tufts University (Forum, 1990). Faculty throughout Tufts were paid to attend the workshop for two weeks. Science faculty served as resource people to help others develop modules for incorporating the environment into courses in the humanities, science, and law.

In the vocational colleges, both administrative and teaching staff need to know more about pollution prevention. In-service workshops should be developed cooperatively between the technical colleges, government, and technical assistance programs.

b. Support Grant Applications

Faculty should be supported in their efforts to gain grants for pollution prevention. Faculty awareness and concern must precede that of students. Marvin Fleischman (Fleischman, 1988) and others (PPTF, 1990) have encouraged faculty development through related research. Fleischman says money is available; in fact, the EPA is currently looking for research to fund. The EPA hopes to expand its grants program under the new federal Pollution Prevention Act. Faculty should be supported in their

efforts to gain grants for pollution prevention, and encouraged to consult and take summer positions in the field.

An example of the opportunities for waste minimization grant money comes from Professor Michael Semmens at the University of Minnesota. Semmens is a member of a consortium that has applied for an EPA grant to fund the Center for Clean Manufacturing and Treatment Technologies. If funded, this project would generate research on pollution prevention technologies.

The federal government and industry should provide research opportunities for faculty. Unless pollution prevention and the environment become a major area to obtain money and publications, professors will not likely pay any attention to it. Government and industry should therefore provide research opportunities for faculty. OWM should sponsor workshops to identify critical research and education needs.

7. PROMOTE PARTNERSHIPS BETWEEN ACADEMIA AND OTHERS

a. Encourage Collaboration Between Industry and Educational Institutions

Government should encourage collaboration between industry and educational institutions in creating, modifying, or delivering courses.

A growing number of businesses have in-house expertise and experience in pollution prevention. Colleges, universities and other educational institutions should draw on this expertise as much as possible. For instance, the post secondary institutions could collaborate with individuals directly involved in pollution prevention to create, modify, or deliver courses. An example of such a partnership is provided by the Alaska Health Project, a private, non-profit organization that has taught several courses in waste reduction for the University of Alaska. An EPA grant helped support the courses.

b. Need for Industry Advisory Boards for Educational Institutions

Educational institutions should establish industry advisory boards to express need, and guide and develop curriculum for appropriate subject areas.

The Minnesota Pollution Prevention Task Force (PPTF, 1990) has suggested that industry consultants meet regularly with academics to advise them on course content. This is being done at University of Minnesota-Duluth. The Duluth campus appears more sensitive to preparing students for solving environmental problems than the Twin Cities campus. Part of the difference in approach may be attributed to Duluth's industry advisory board. The board meets once a year with the engineering department to review programs and provide feedback. This may help the Duluth department respond more quickly to change in industry needs.

The vocational college system offers a good working example of industry advisory boards. The curriculum at these colleges is shaped through program advisory committees. Committee membership includes technical college staff and industry representatives. Through this committee process, the technical colleges have demonstrated a will to respond to business needs.

c. Communicating Industry Needs

Industry should more actively communicate its need for environmental and pollution prevention professionals. Industry has said many times that it needs managers, financial analysts, and marketers that are aware of the issues and opportunities in environmental protection. Educational institutions need to hear this message loud and clear. It could be broadcast informally, or through specially arranged workshops and conferences, or through an established industry advisory board to the university or college.

An effective place to spread this message is at the placement office. If industry recruiters stress the importance of pollution prevention and placement officers see the best jobs going to students with pollution prevention experience, students will demand pollution prevention instruction for their own career advancement.

There is a widespread misconception that pollution prevention is not mainline engineering and that environmental engineers earn less. Professor Marvin Fleischman (Forum, 1990) says this perception is false. Engineers with experience in safety, health, and environmental protection actually earn more. This applies to other work situations and careers as well. For instance, by hiring business students with environmental expertise, industry not only puts its money where its mouth is, but also sends a strong message to the placement office. If the best jobs go to students with an environmental edge, demand for green business courses will sky-rocket.

d. Continuing Education

The special potential for continuing education courses for industry staff should be explored and developed.

The continuing education needs of industry and the potential offerings of such programs at educational institutions may provide an especially useful context for enlarging the partnership in the area of pollution prevention. These possibilities should be aggressively pursued.

8. LEVERAGE NATIONAL EFFORTS

a. Support a National Forum

Educational institutions, industry, and government in Minnesota should support a national forum on pollution prevention education. The State Congress on Pollution Prevention (ASIWPCA, 1990) recommended that a collegial national forum could

highlight activities, examine innovations, and build consensus on future directions in pollution prevention.

Minnesota should support federal government initiatives to build pollution prevention educational activities. For instance, EPA is currently funding curriculum development and research. The state and educational institutions need to take advantage of these projects.

A specific project worthy of support is the National Wildlife Federation's CCC proposed Center for Business Excellence in Environment and Natural Resources.

b. Influence Accreditation Boards

Minnesota should work to influence pollution prevention education through accreditation boards in the following ways:

- ▶ The American Board of Engineering Technology (ABET) will be requiring safety and health in the curriculum in the next couple of years (Forum, 1990). In conjunction with this change, ABET could also initiate specific accreditation requirements for pollution prevention.
- ▶ Other relevant accreditation boards should initiate specific requirements for pollution prevention. For instance, business accreditation boards could play a large role by requiring exposure to environmental and business issues.

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V. INSTITUTIONAL BARRIERS

A. INTRODUCTION AND PROBLEM STATEMENT

Rules, behavior patterns, prescribed practices, and adherence to established forms are common ideas associated with institutions. These characteristics used to define institutions are the focus of this chapter. The term institution is used to tie together a suite of barriers to pollution prevention. These barriers involve habits and inertia that individuals experience at work while using equipment or technologies, or performing routine operations. Also included within this category of barriers are societal beliefs that impact the work environment.

These barriers relate to barriers addressed in other chapters of this report. Some organizational habits manifest themselves as economic or educational barriers. Other barriers are societal beliefs that impact regulatory behaviors. The specific barriers selected for this chapter are largely independent in that they reinforce behavior patterns that serve as impediments to the implementation of preventive actions.

Three categories of institutional barriers are addressed in this chapter:

- ▶ Organizational;
- ▶ Technical; and
- ▶ Societal.

Organizational barriers reflect the ways in which companies manage human and material resources. Technical barriers address the development and use of technologies and operational practices. Societal barriers describe some ways in which society impacts pollution prevention efforts.

B. INSTITUTIONAL BARRIERS TO POLLUTION PREVENTION

1. ORGANIZATIONAL BARRIERS

a. Lack of Top Management Support

Management sets the tone for the overall goals of an organization. It is widely recognized that without strong commitment by upper management, new initiatives (e.g. pollution prevention) will falter. This is underscored by a recent report on pollution prevention prepared by the Harwood Group for the state of Michigan (Harwood Group, 1990). The report quotes an industry representative as saying:

It's always a battle with senior management, 'How much money will be allocated to the waste reduction program?'--because their bottom line is always going to be profit.

Even when top management states support for pollution prevention, there can be problems. For instance, one problem seen quite often is that of top management

agreeing to the concept of pollution prevention, issuing words and policy statements, but not following through with any real action (Smith, 1990). Companies with significant pollution prevention achievements almost always have top management involved and committed.

b. Lack of Clear Communication of Priorities or Support

Pollution prevention can be a top priority and yet failure can result because the policy is not clearly communicated to employees. It is essential that the policy of pollution prevention be articulated clearly to employees at all levels.

c. Organizational Structures May Separate Environmental Decisions From Production Decisions

In many manufacturing industries, the environmental engineers or managers do not have a direct line of command over production areas. For example, in one Minnesota manufacturing facility, the environmental manager must work up through the engineering department hierarchy to the general manager, then back down through the production hierarchy in order to work with production engineers and personnel. This situation blocks communication and credibility and poses significant barriers to pollution prevention efforts by the environmental manager.

d. Habit and Inertia May Inhibit Change

Reluctance to change is one of the most often cited organizational barriers to pollution prevention. Individuals resist change and prefer doing things "the old way." A report prepared for the Michigan Office of Waste Reduction Services documented that there can be resistance to adopting and implementing waste reduction efforts among frontline employees (Harwood Group, 1990). Cindy McComas, director of the Minnesota Technical Assistance Program (MnTAP) states that reluctance to change is one of the biggest problems MnTAP encounters (Smith, 1990). MnTAP works to open minds to the possibilities and opportunities inherent in pollution prevention.

e. Lack of Involvement of Affected Workers

Often, middle and top-level corporate management will move forward with implementation of pollution prevention projects without effectively communicating with or involving affected workers. Failure to effectively communicate with employees can cause projects to backfire. One example involves a Minnesota firm working to implement a substitution of zinc cyanide to alkaline non-cyanide zinc plating solutions. Facility management did not properly explain to workers why the solutions were being changed and why additional bath maintenance was needed. Product quality and productivity suffered as a result.

f. Reward System Does Not Focus on Pollution Prevention

Industry reinforces the importance of certain goals, such as quality or safety, through reward systems. Unfortunately, pollution prevention and other environmental achievements are not often rewarded. Bonuses and pay raises for management and other employees are often based on cost savings and production increases rather than environmental and safety achievements (PPTF, 1990).

2. TECHNICAL BARRIERS

a. Firms May Lack the Technical Ability to Apply Preventive Methods and Technologies

Significant progress in pollution prevention can be made through simple actions such as improved housekeeping and inventory practices. Other preventive projects require methodologies or technologies that involve more sophisticated actions. And some companies lack the in-house expertise needed to identify, select and implement pollution prevention actions. Says one Michigan industry representative "Technical know-how is a problem for us--we have to hire consultants and contact our suppliers to help us consider changes we can make to reduce waste (Harwood Group, 1990)."

b. Frequent Changes to Output, Product Design and Other Factors May Make Implementation More Difficult

For instance, a production line may run "specials" where the odd-ball color has to be purchased and matched and then disposed of. This practice may even require the use of more toxic pigments. Because production lines may have to be cleaned between runs, excess waste is produced from cleaning materials and disposal of left-over raw materials that may not be used again. If changes in product design require modifications to production lines, it may be difficult and confusing to maintain pollution prevention measures between runs. Industry has moved a long way from Henry Ford's maxim, "You can have any color you want as long as it is black!"

c. Lack of Information about Sources of Waste and Releases, Alternative Strategies, and Resources

Because they are unaware of pollution prevention techniques, companies often pursue the "safe" route of traditional waste management or pollution control (Weisman et. al., 1990). Lack of information is perhaps the largest technical barrier. Several sources (Weisman et. al., 1990; Harrison et. al., 1989; Smith, 1990) have documented that lack of information and technical assistance can discourage companies from implementing pollution prevention. The Minnesota Plan of Action (Haines, 1989), prepared for the OWM, determined that lack of technical information delayed or prevented solvent reduction for some large quantity generators. The Illinois State Policy Options report (Thomas et. al., 1990) found that many firms lack basic information on what their wastes are and how they could be efficiently reduced. The report concludes "it is reasonable to

assume that firms have not done more to reduce the amount of wastes they generate simply because they are unaware of available waste reduction options."

These sources also identify a key block to information sharing: the desire to conceal confidential business information. Companies don't exchange useful information on pollution prevention because it could decrease their competitive advantage. For example, Dave Benforado, senior environmental specialist at 3M, described a case where a company searched 20 years for a new catalyst for nylon production that would cut waste in half (Smith, 1990). Benforado said "Companies are reluctant to share this information because it is their lifeblood...Would it make sense to ask them to share it?" Joe Lindsly, issue manager for Dow Chemical said "internally, information exchange is no problem, but externally, we are afraid of letting our technology get away from us. We have gone as far as we can go in exchanging specific technologies." But Thomas Stanczyk, senior vice president with Recra Environmental, says companies even have trouble sharing information internally: "You find many instances where different divisions within the same company just don't talk to each other (Smith, 1990)."

d. Current Preventive Applications Not Available

Once a firm gets past the first simple steps to pollution prevention (e.g., inventory control and better housekeeping) further progress may require feedstock substitutions or process modifications. For some firms, these steps may require sophisticated technology that has not yet been developed. An example involves the wood products industry. Alternative coating processes used for metal, such as powder coating or electro-static coating, are either expensive or impossible to use for coating wood.

A Michigan report identified several companies who claimed that technology has not yet caught up with pollution prevention needs (Harwood Group, 1990). One company interviewed for this report said "For us, the technology may never be there--our industry is too small to inspire much research and development of technology." Another added "We're having difficulty finding equipment which will break down the contaminants in our process--it just doesn't exist."

3. SOCIETAL BARRIERS

These barriers are external to industrial facilities but nevertheless are restraining progress in preventing pollution in Minnesota.

a. Perception That Pollution Prevention Addresses Only Manufacturing Processes

To date, pollution prevention has received attention largely as a technique for manufacturing industries to reduce waste. Less often has it been extended beyond the industrial setting to other pursuits, such as dry cleaning, vehicle services, agriculture, energy production and conservation, and even to the home. This lack of extension of pollution prevention beyond a narrow arena poses a barrier to marshalling additional support and resources for pollution prevention at all points where waste and toxic chemicals are generated. Extension of pollution prevention beyond industrial processes

to other sectors and activities of society has great potential to create effective synergies between these various programs.

b. Lack of Consumer Environmental Awareness

The recent boom in green marketing is testament to the fact that consumers have made progress in using their buying power to leverage change on the part of industry. However, for continued industry focus on pollution prevention, the public will have to demonstrate that their concern is not a fad. The public will have to go further and educate themselves. Green awareness on the part of consumers has only touched the tip of the iceberg. The public has much to learn about demand for products and services that result in pollution.

C. RECOMMENDATIONS

1. CONTINUE AND EXPAND TECHNICAL ASSISTANCE

a. Support Minnesota Technical Assistance Program (MnTAP)

It is widely recognized that government sponsored technical assistance and information exchange is critical to overcoming technical barriers to pollution prevention (Smith, 1990; Harrison et. al., 1989). Minnesota already has successful programs on which to build. For example, the Minnesota Technical Assistance Program (MnTAP) is nationally known for its work with small and medium-sized businesses. Its successful approach through phone consultation and on-site visits should be continued and expanded.

b. OWM Should Continue to Promote the Minnesota Guide to Pollution Prevention Planning

The Minnesota Guide to Pollution Prevention Planning, to be available in April 1991, provides industry with a comprehensive tool by which to develop strategies and programs to prevent pollution. Based in part on results from focus groups of industry representatives, the guide defines pollution prevention, describes how to prepare a prevention policy statement, form internal pollution prevention teams, identify waste streams and toxic chemical releases, identify and select pollution prevention options, perform cost-benefit analyses and evaluate progress. Work should continue to build on the efforts put forth to develop the Minnesota guide.

c. Continue Research and Development in Pollution Prevention

For some industry areas, little or no prevention methods and technologies are available. Minnesota's pollution prevention grant program is an appropriate vehicle to target research gaps and provide financial assistance to stimulate innovation, research, and development. This program also promotes technology transfer and, because all grant projects are public information, can help overcome barriers resulting from confidential business information.

2. SUPPORT AND EXPAND TOXIC CHEMICAL REPORTING REQUIREMENTS

a. Support Continued Efforts to Provide Community Right-to-Know Data to the Public and Involve Community in Environmental Protection

In overcoming inertia, a Tufts University report has identified SARA Title III (the toxic chemical storage and release reporting requirements) as "providing a powerful incentive for companies to evaluate and improve their traditional approaches to chemical risk management (Editors, CEM, 1990)." The report adds that since passage of this federal act in 1986 "companies are looking deeper into their operations and intensifying activities aimed at the reduction of accidental and routine releases of hazardous chemicals." An article in The Economist (Editors, Economist, 1990) summarized this trend: "In America, nothing has galvanized senior management as much as Title III of the Superfund Amendments and Reauthorization Act."

The actions of several Minnesota companies demonstrate the effectiveness of the toxic chemical reporting requirements. For example, 3M has made a commitment to reduce hazardous material releases by 90 percent by the year 2000. IBM's Rochester plant has set a goal to eliminate CFCs from plant operations in early 1990. Sheldahl has made a commitment to reduce and eventually eliminate use of methylene chloride in its plant operations.

b. Expand Toxic Chemical Reporting Requirements to Other Industry Groups

Because the toxic chemical release (TRI) reporting requirement has been successful in overcoming some organizational inertia, efforts to expand reporting criteria to other industries should be supported.

This report recommends that the requirement to submit toxic chemical release reports be expanded to some non-manufacturing facilities, including metal mining, electrical services, chemicals and allied products, and others (see recommendations in Chapter II). It also recommends that efforts be continued to survey facilities in other sectors which may generate wastes and toxic chemicals. This additional information will be a valuable complement to TRI data already being collected and serve to motivate other facilities to pursue prevention projects.

c. Support Initiatives That Encourage Industry to Self-Evaluate and Implement Prevention Projects

Nonregulatory programs that encourage industry to make fundamental changes in their practices and attitudes are an effective way to move industry beyond just compliance. Any new initiatives that encourage industry to self-evaluate and direct their own change should be encouraged. An example of such an initiative is Minnesota's Toxic Pollution Prevention Act with its requirement to prepare and maintain pollution prevention plans. The act requires certain manufacturing facilities to prepare these plans. The planning process requires that specific issues be addressed. However, the planning process encourages facilities to take ownership of the plan and to use it as a strategic document

for future prevention project implementation. By encouraging facilities to examine and regularly reexamine wastes and toxic chemical releases, the requirement to prepare toxic pollution prevention plans will help to overcome organizational inertia.

Another example of a non-regulatory program is EPA's Industrial Toxics Project (EPA, 1990). The project's goal is to reduce the release of 15 to 20 targeted toxic chemicals by 33 percent by 1992, and 50 percent by 1995. To achieve this goal, EPA plans to seek voluntary, measurable commitments from the top 600 corporate toxic chemical releasers nationally. EPA will provide outreach and technical support to the volunteer facilities.

It is recommended that the OWM expand its targeting efforts and call for voluntary reductions in specific chemical releases.

3. SUPPORT TECHNOLOGY TRANSFER VIA NON-GOVERNMENTAL ENTITIES

OWM should solicit support for information transfer via non-governmental organizations such as business groups, chambers of commerce, trade associations, industrial suppliers, and equipment vendors.

So-called "low" technology is sometimes shared among companies (Smith, 1990). This may include advice on separating and measuring individual waste streams and general pointers on pollution prevention. Information sharing must be expanded to a broader audience and include additional pollution prevention applications in such a way as to not violate proprietary information. Government and industry should promote such cooperation, especially through trade associations and other industry-specific organizations. Trade associations can play an indispensable role in information transfer (Harrison et. al., 1990). Other statewide networks such as Minnesota Extension Service could also become an important tool for distributing information. Suppliers can play an important role in educating their customers. One example is Dow Chemical, which operates a program called "Chem Aware" that helps companies reduce reliance on chlorinated solvents (Smith, 1990).

4. INDUSTRY SHOULD REFORM POLICY AND PRACTICES TO ELIMINATE ORGANIZATIONAL AND TECHNICAL BARRIERS

a. Industry Should Build Prevention into its Culture Through Top Leadership Support and Formal Programs

Industry representatives of Minnesota's Pollution Prevention Task Force stress that when goals, such as pollution prevention or quality or safety, are built in to company culture, results are guaranteed (PPTF, 1990). In addition to top-level leadership, one way to make pollution prevention an integral part of company culture is through formal programs. For instance, 3M's Pollution Prevention Pays program incorporates a number of formal organizational structures. There is an operating committee made up of vice presidents whose responsibility is to identify and overcome barriers to change. Another high level committee focuses on the environmental compatibility of materials and

incorporates them into products wherever possible. An internal environmental report also helps send the message that pollution prevention is a top priority (Smith, 1990).

b. Industry Should Involve Employees in Prevention Efforts

It is generally recognized that pollution prevention succeeds when employees are involved in the process (PPTF, 1990). Involvement can include increased flow of internal communication (Smith, 1990), and team approaches with pollution prevention coordinators in each department. This strategy is currently used by several companies, including: Burroughs and DuPont in Pennsylvania; Babcock and Wilcox in Ohio; and Cinch Cylindrical Division in Minnesota. "Environmental circles" are conducted at the grass roots level where line workers and supervisors brainstorm on a weekly or bi-weekly basis (Haines, 1989). In a similar vein, DuPont has created a plant-wide group called EWAT--Employee Waste Awareness Team. This voluntary team establishes and coordinates pollution prevention efforts. Meeting monthly, the team's goals are to increase awareness, reduce disposal costs, reduce exposure, ensure compliance, and reduce waste generation.

• c. Industry Should Institute Employee Incentive and Bonus Programs and Train Employees That Work with Hazardous Materials

The Minnesota Pollution Prevention Task Force has observed that, in general, neither upper management nor lineworkers are compensated based on environmental policies or programs (PPTF, 1990). Yet, it is well-known that employee attention can be gained through the compensation programs. If someone institutes an effective pollution prevention strategy, companies should consider some form of compensation. Conversely, one task force member suggests bonuses should be prohibited if costly clean-ups result from carelessness or failure to address pollution-related problems. The effectiveness of this approach is demonstrated within DuPont, where the corporate culture is safety. Those familiar with DuPont's programs state that division managers would rather come in with a poor profit and loss record than a poor safety record.

Inertia can be addressed through other employee incentive programs. For instance, Amoco administers a program called "End Share" where the money saved from reducing wastes is divided up among the employees (Forum, 1990). Dow Chemical offers non-monetary incentives focused on peer recognition for pollution prevention ideas (Smith, 1990). DuPont has a \$150 Waste Reduction Award for any employee who champions a process change leading to pollution prevention (Haines, 1989). To combat inertia, and promote pollution prevention, companies should train new employees and re-train existing employees in the philosophy and practice of pollution prevention.

d. Where Feasible, Companies Should Reform Practices to Eliminate Technological Barriers

For instance, marketing departments may decide to offer one shade of red widgets instead of five, thereby facilitating pollution prevention on painting lines. Or if barriers

are related to frequent changes in production, a large facility may dedicate specific production lines to new prevention applications.

5. ENCOURAGE PUBLIC EDUCATION IN POLLUTION PREVENTION

An educated community is an involved community and this can have a positive effect at many levels. Pollution prevention at home in the area of household hazardous wastes, energy conservation, and solid waste reduction is a practice that can spill over to society at large. Greater consumer demand for environmentally compatible products can help companies change. And sometimes the community can directly help companies overcome organizational inertia.

The Michigan report, Starting Points for Action on Waste Prevention, contends that some companies just haven't asked the question "Why aren't we doing more to prevent and reduce our waste?" External factors such as community pressure can precipitate action (Harwood Group, 1990). Company representatives interviewed for the Michigan report testify to the effectiveness of this strategy:

"I think it was about one year ago that we started considering waste reduction. It was from the growing awareness throughout the country--the environmental movement. This combined with our realization that we are running out of landfill space."

"There has been such a growth of awareness on the landfill issue, on the use of CFCs in products, and on other environmental issues that we revisited our waste management program to see what else we could do."

"We held a meeting on Earth Day about waste reduction--the heightened awareness of the community showed us that we had to get in line with their thinking."

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VI. GOVERNMENT AS A ROLE MODEL

A. INTRODUCTION: PROBLEM STATEMENT AND CONTEXT

The Minnesota Toxic Pollution Prevention Act (TPPA) requires that this report "describe ways in which government may serve as a role model in pollution prevention." An examination of this issue is consistent with increased recognition over the past several years that government can affect policies and practices not only through legislation, but also by its own actions. This opportunity is clearly present in the area of pollution prevention.

Government activities from various levels generate wastes and release a wide variety of toxic chemicals into the environment. Although data on government use and release of toxic chemicals is fragmented and incomplete at this time, it is known that some facilities are regulated as large quantity hazardous waste generators (generating more than 1,000 kilograms per month). Further, it is likely that other toxic chemical wastes are directly released to air, water and land resources. Government operations ranging from vehicle maintenance to printing shops to prison industries use and release hazardous substances in industrial quantities. Example types of activities, wastes, and releases are provided in Table 1.

As both a regulator and waste generator, government has a tremendous opportunity to lead in development and adoption of pollution prevention programs. Institution of government-wide pollution prevention programs stands to benefit many constituencies. Citizens benefit from a cleaner environment and industry benefits from the resultant technology transfer. Participating agencies and departments benefit from reduced liabilities associated with hazardous wastes and reduced disposal and treatment costs. In addition, participating departments save expensive raw materials, comply with existing environmental regulations, improve the image of government, and reduce employee exposure to hazardous materials.

B. RATIONALE FOR GOVERNMENT TO LEAD BY EXAMPLE

One compelling reason for government to institute pollution prevention programs is credibility with industry. Industry's voice has been prominent in the call for government to serve as a model of pollution prevention. For instance, industry members of the OWM Pollution Prevention Task Force (PPTF, 1990) have said that it only makes sense that government should operate from a position of credibility and compliance while it asks industry to do the same. Government facilities are currently exempt from reporting toxic chemical releases under the Community Right to Know Act. Because they do not report, they do not have to prepare pollution prevention plans under Minnesota's TPPA. While such exemptions may be justified in many cases based on the extent of chemical use, by failing to include government operations which are similar to private sector activities which are required to prepare plans, government misses an opportunity to build credibility and trust.

TABLE 1

EXAMPLES OF HAZARDOUS WASTES FROM GOVERNMENTAL FACILITIES	
Operations/Sources	Wastes and Releases
Highway departments	solvents used crankcase oils paint thinners waste paints
Laboratories	pesticides heavy metals organic chemicals
Vehicle maintenance	solvents used crankcase oils lubricants paint thinners waste paints
Photo labs	photochemicals
Print shops	waste inks solvents
Prison industries	solvents used crankcase oils paint thinners chlorofluorocarbons (CFCs) waste paints

This recognition has also come from within government. As pointed out in the "Proceedings of The State Congress on Pollution Prevention" (ASIWPCA, 1990), decisions related to procurement, facility management, energy use, and vehicle maintenance, to name a few, can have profound impacts on the environment. In addition, if government wants industry to integrate pollution prevention into mainstream environmental management, government must do the same. The State Congress on Pollution Prevention concluded that government must lead by example and make pollution prevention a priority in carrying out its daily activities. In a similar vein, EPA's Pollution Prevention Division recently urged local governments to establish their own in-house pollution prevention programs through the use of audits and waste minimization assessments (Hanlon, 1990). Industry has been adopting these techniques and has found them effective in achieving compliance and in identifying pollution prevention opportunities.

Other governmental organizations have called for government to act more aggressively in pollution prevention. In January, 1990, the joint National Governor's Association-National Association of Attorneys General (NGA-NAAG) Task Force on Federal

Facilities proposed a number of solutions for cleanup and compliance at federal facilities (NGA-NAAG Task Force, 1990). Among their recommendations were several pertaining to pollution prevention. The NGA-NAAG task force recommends that:

- ▶ Federal facilities be required to conduct waste audits and prepare pollution prevention plans; and
- ▶ Federal facilities should seize every opportunity to prevent pollution, thus becoming pacesetters for private industry.

Another rationale for government to become a leader in pollution prevention is to anticipate requirements that may arise from new laws and regulations. At the present time, government entities are not required to report toxic chemical releases under the Emergency Planning and Community Right-to-Know Act. Therefore, they are not required to prepare and maintain pollution prevention plans.

In a report to the state legislature, Minnesota's Emergency Response Commission (ERC) recommends expansion of the reporting requirements to include some public facilities: colleges, universities, and prisons (Minnesota Emergency Response Commission, 1990). More government facilities could legitimately be captured by the threshold requirements for toxic chemical release reporting. For instance, some government facilities in Minnesota (i.e., Hennepin Technical Vocational College, University of Minnesota, Minnesota State Fair, Dakota County Technical College, Northeast Metro Technical College, Minnesota Air National Guard in Duluth, Stillwater Prison, and Hennepin County Medical Center) are regulated as large quantity hazardous waste generators. The probability is high that some fraction of these facilities may also use and release toxic (TRI) chemicals.

Lastly, it makes good economic sense for government to act as a role model in pollution prevention. Reducing wastes, hazardous chemical use, and toxic chemical releases saves money and promotes efficiency. Especially in an era of government fiscal austerity measures, pollution prevention should be viewed as a key element of a strategy to reduce costs and invest for the future.

C. EXAMPLES OF GOVERNMENT SERVING AS A ROLE MODEL

Governmental units across the country and at all levels--from city government to the federal Department of Defense--are adopting pollution prevention strategies. The following describes a select number of programs.

Local units of government have a high potential to serve as role models (Hanlon, 1990). In 1988, Mayor Tom Bradley directed the Los Angeles City government to reduce its use of hazardous substances and minimize the generation of hazardous wastes (Bradley, 1988). This mandate has included compliance with the California Safe Drinking Water Act (even though municipal governments are exempted), establishment of technical assistance and policy programs, and development of a city-wide hazardous waste minimization program.

Leading by example has also been undertaken at the state level. In 1987, New York State passed an act requiring all state agencies to annually assess the environmental problems created by their operations. The act requires the agencies to submit an annual report detailing the findings of audits, steps taken to assure compliance with state regulations, and progress made to reduce pollution.

Minnesota state government is committed to displaying leadership in solid waste management and reduction. This provides a close analogy to pollution prevention. The Solid Waste Reduction and Recycling Act of 1989 mandates that governmental units adopt policies and practices that promote reduction, reuse, and recycling. Under the act, public agencies must aggressively procure items that are reusable, recyclable, and made from recycled materials. Agencies must also compost their yard waste. By January 1, 1991, all public buildings must have recycling bins in place. The mandated state agency recycling goal of 40 percent is higher than any goals set for Minnesota counties. It is precisely this kind of state activism and leadership that must occur in the area of pollution prevention.

Another example is the United States Department of Defense (DOD). DOD has adopted a goal to cut in half hazardous waste generation from depot maintenance operations by 1992 (Editors, Environment Reporter, 1990; Editors, Waste Tech, 1990). These depots now produce 75-80 percent of the military's hazardous waste. In addition, EPA will be assisting DOD in administering pilot pollution prevention programs at three facilities: Langley Air Force Base, Fort Eustis, and Norfolk Naval Base. The concept behind these projects is to create a "model community plan." Multi-media pollution prevention programs, mandatory recycling, and an employee reward system would all serve as a model for environmental responsibility at federal facilities.

D. RECOMMENDATIONS

1. THE GOVERNOR SHOULD ISSUE AN EXECUTIVE ORDER TO AGENCY AND DEPARTMENT HEADS REQUIRING AN EXAMINATION OF OPERATIONS AND THE INSTITUTION OF POLLUTION PREVENTION PROGRAMS

Because pollution prevention is a philosophy and approach to addressing problems, the Governor could quickly achieve changes in governmental agencies through an executive order. This action has been taken in at least two other instances concerning environmental issues. In 1988, the Governor issued an order to agency heads to, wherever possible, procure goods made from recycled materials, and recycle all waste produced in offices. Most recently, on January 17, 1991, the Governor issued an executive order directing all public agencies to promote no net loss of wetlands. These directives call for an increased awareness and change in the way agencies pursue their business, a concept central to the implementation of pollution prevention.

2. OWM SHOULD UNDERTAKE AN ANALYSIS OF TOXIC CHEMICAL RELEASES FROM GOVERNMENT FACILITIES AND CURRENT POLLUTION PREVENTION EFFORTS AT THESE FACILITIES

As noted in this chapter, data regarding toxic chemical use and releases from government facilities is very limited. This is largely because such facilities are not required to report releases under the Emergency Planning and Community Right-to-Know Act. Alternative means to collect and analyze data were beyond the scope of this report. Information regarding current government facility efforts in pollution prevention is also not currently being collected and analyzed. The OWM should conduct a survey of selected types of government facilities in order to identify patterns of waste generation and toxic pollutant releases from such facilities. The results of such a survey should be reported in the first Toxic Pollution Prevention Evaluation Report, due to the Legislature by December 15, 1992. This inventory should also include an analysis of current and potential governmental product or process procurement specifications which may present barriers to pollution prevention and recommend strategies for the removal of these barriers.

3. OWM SHOULD INITIATE A PILOT PROJECT IN POLLUTION PREVENTION TARGETED AT A SELECT NUMBER OF GOVERNMENTAL FACILITIES

OWM should seek volunteers from among those governmental facilities which have been identified as large releasers of toxic chemicals. Facilities from the Minnesota Department of Transportation, Print Communications, colleges, University of Minnesota, vocational colleges, local units of government, and prisons should be considered. OWM should work with MnTAP to provide technical assistance for this pilot project. The results of this project should be analyzed in the Pollution Prevention Evaluation Report.

4. TOXIC CHEMICAL REPORTING REQUIREMENTS SHOULD BE EXPANDED TO INCLUDE GOVERNMENT FACILITIES RECOMMENDED IN THE MINNESOTA EMERGENCY RESPONSE COMMISSION'S REPORT TO THE LEGISLATURE

Current law requires manufacturing facilities (Standard Industrial Classification codes 20-39) with 10 or more employees and using threshold quantities of hazardous chemicals to report toxic chemical releases. The Minnesota Emergency Response Commission (ERC) recommends that select government facilities also be required to report. Since all facilities required to report toxic chemical releases must also prepare pollution prevention plans, these government facilities should also be required to prepare and maintain pollution prevention plans.

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