United States General Accounting Office

GAO

Report to Congressional Requesters

February 2001

# ENVIRONMENTAL PROTECTION

# EPA Should Strengthen Its Efforts to Measure and Encourage Pollution Prevention



GAO-01-283

# Contents



**Abbreviations**

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| ALAPCO | Association of Local Air Pollution Control Officials |
| EMS | Environmental Management System |
| EPA | Environmental Protection Agency |
| GAO | General Accounting Office |
| SEP | Supplemental Environmental Project |
| STAPPA | State and Terrirotiral Air Pollution Program Administrators |
| TRI | Toxics Release Inventory |

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**United States General Accounting Office**
**Washington, DC 20548**

February 21, 2001

The Honorable Sherwood Boehlert
The Honorable Cal Dooley
The Honorable James Greenwood
House of Representatives

In response to your request, this report examines the extent to which companies have adopted pollution prevention measures, the major incentives encouraging companies to use pollution prevention strategies, and the major disincentives that discourage their use of these strategies.

Unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the date of this letter. At that time, we will send copies to appropriate congressional committees, the Administrator of the Environmental Protection Agency, and the Director of the Office of Management and Budget. We will also make copies available to others upon request.

Please call me at (202) 512-3841 if you or your staff have any questions. Major contributors to this report are listed in appendix I.

Sincerely yours,

David G. Wood

David G. Wood
Director, Natural Resources
and Environment

# Executive Summary

## Purpose

Each year American industry generates billions of pounds of toxic waste, which can pose risks to the health of workers, consumers, and the public. Traditionally, efforts to control pollution have focused on the treatment or disposal of pollutants after they are created, often with "end-of-pipe" pollution control technologies. In recent years, however, federal and state regulators have given greater attention to controlling pollution at the source by avoiding the creation of pollutants in the first place—an approach commonly referred to as pollution prevention.

Interested in the potential for U.S. industry to make greater use of pollution prevention activities, several Members of Congress asked GAO to (1) examine the extent to which companies have employed pollution prevention strategies, (2) identify the major factors that facilitate or encourage companies to use pollution prevention strategies, and (3) identify the major factors that discourage their use of pollution prevention. In addressing this issue, GAO, among other things, examined quantitative data available from EPA and other sources on companies' pollution prevention practices, interviewed representatives of relevant national organizations and individual companies, and reviewed existing literature on the subject. GAO also conducted site visits to a number of firms to obtain detailed insights on their experiences in employing pollution prevention measures.

## Background

While end-of-pipe pollution control strategies have helped further the nation's environmental goals and promote facilities' compliance, they do not necessarily keep "controlled" pollutants from entering the environment. For example, a wastewater treatment plant may extract hazardous pollutants before they are discharged into a receiving body of water, but the resulting sludge generated by its pollution control process may create a hazardous waste that must be disposed in a landfill—in some cases posing continued environmental and health risks. Likewise, other control strategies often result in the shuffling of pollution from one medium to another without actually reducing pollution entering the environment.

The Pollution Prevention Act of 1990 established a national policy that pollution should be prevented or reduced at its source. Under the act, pollution that cannot be prevented should be recycled or treated in a safe manner; disposal or other releases should be used only as a last resort. The act also directed EPA to develop and implement a strategy promoting source reduction, which it defined as any practice that reduces (1) the amount of any hazardous substance, pollutant, or contaminant from

entering any waste stream or being released into the environment prior to recycling, treatment, or disposal, and (2) the hazards to public health and the environment associated with the release. These measures can range from simple techniques, such as covering exposed containers of volatile organic compounds or tightening loose pipe connections, to completely redesigning a production process or reformulating a product.

Among other things, the act also expanded the agency's Toxics Release Inventory (TRI) to include source reduction information from reporting facilities. Created by the Congress in 1986 under the Emergency Planning and Community Right-to-Know Act, TRI is an information system containing data on estimated releases of hundreds of chemicals that companies report annually to EPA and the states. However, the reporting requirements apply only to a certain set of industries and to certain chemicals of concern, and not all facilities. The Pollution Prevention Act requires each of these affected facilities to report, among other things, (1) the quantity of toxic chemicals entering any waste stream prior to recycling, treatment, or disposal; (2) a comparison of the ratio of a chemical's production or use from the facility's previous report; and (3) the source reduction practices used, if any, to reduce chemical waste. EPA compiles the data and makes them available to the public.

## Results in Brief

Limited quantitative data exist on the extent to which American industry has sought to use pollution prevention methods to reduce pollutants discharged from its facilities. Specifically, Toxics Release Inventory data show that in each year between 1991 and 1998, approximately one-quarter to one-third of reporting firms implemented at least one pollution prevention measure. Nonetheless, according to studies conducted by individual state agencies and other organizations (as well as the large majority of industry participants, regulators, and analysts GAO contacted), additional opportunities exist for pollution prevention that could provide cost-effective ways to help meet environmental requirements. EPA officials note that the limitations of available data inhibit both their ability to ascertain the extent to which companies use pollution prevention practices, and their attempt to target efforts to further encourage these practices. Agency officials acknowledged that revisions in the information companies provide TRI could significantly help address these needs.

For many companies, the opportunity for a financial return is the primary impetus for pursuing pollution prevention. Another key factor is the prospect that pollution prevention could improve a company's public or community image. Representatives of several firms told GAO, for example,

that the public availability of Toxics Release Inventory data on facilities' discharges provided a powerful incentive to minimize releases of toxic pollutants. Other factors that facilitate or encourage firms to pursue pollution prevention include (1) laws and regulations that reduce allowable pollutant discharges while allowing companies the flexibility to achieve the reductions through pollution prevention; and (2) the proliferation in recent years of business strategies, such as environmental management systems, under which firms look comprehensively at the environmental impacts of their products and services. Such strategies, while not directly intended to promote pollution prevention, nonetheless create an environment in which pollution prevention measures are more likely to be adopted.

Technical challenges associated with new and sometimes unproven techniques are one of the principal barriers hindering the wider use of pollution prevention. While some pollution prevention techniques involve relatively simple, common sense practices, others can involve significant changes, such as revamped production practices or changes in raw materials. These technical challenges are sometimes compounded by the preference among key decisionmakers to rely on "tried and tested" methods. Second, pollution prevention methods may be rejected because they are not considered sufficiently profitable. The decision to adopt a pollution prevention measure may require more justification than a calculation that its benefits exceed its costs. Proponents of the measure may need to demonstrate that its financial return will be greater than the return from alternative investments competing for the firm's capital. Third, regulations that prescribe the use of specific techniques to meet pollutant emission limits sometimes have the unintended effect of discouraging pollution prevention. Recognizing the possibility that agency regulations may have such unintended consequences, the Pollution Prevention Act requires that EPA review its regulatory proposals and determine their effect on source reduction. However, EPA has not systematically tracked its compliance with this provision and therefore does not know the extent to which source reduction has, in fact, been considered in the promulgation of EPA regulations.

# Principal Findings

## Extent to Which Pollution Prevention is Used

GAO's analysis of the Toxics Release Inventory data reveals that in each year from 1991 through 1998, approximately one-quarter to one-third of facilities reported implementing at least one pollution prevention activity. The data also indicate that over the entire 8-year period, about half the reporting companies indicated implementation of at least one pollution prevention measure. EPA's guidance on reporting requirements for the Inventory also states that industrial facilities reporting prevention activities must identify the types of strategies they use. Over the 8-year period, good operating practices, such as improved maintenance or covering solvent tanks when not in use to minimize evaporation, were the most common type of pollution prevention approach, implemented in over 57,000 reported instances. Process modifications, such as installing a new catalyst in a process that substantially reduces the generation of a pollutant or modifying production equipment and piping in a way that generates less waste, were cited in over 40,000 instances. Product modifications, which include changing product design, specifications, or packaging, were implemented in about 10,000 instances.

TRI pollution prevention data, however, should be interpreted with caution. Although companies are required to report emissions of hundreds of toxic chemicals, such as arsenic, benzene, and chlorine, they do not report pollution prevention activities associated with other important pollutants, such as sulfur dioxide and nitrogen oxide emissions from power plants or nutrients from wastewater treatment plants. Second, as EPA officials acknowledged to GAO, ambiguities in the guidance for reporting source reduction activities likely result in inconsistencies in the way sources are reporting their emissions. These officials acknowledged that these problems inhibit their ability (1) to ascertain the extent to which companies use pollution prevention and (2) to target efforts to further encourage these practices. They also agreed that revisions to the information, which the agency presently seeks from companies under their Toxics Release Inventory reporting requirements, could significantly help address these needs.

A number of state agencies have undertaken studies showing how extensively specific jurisdictions or industries have used pollution prevention. For example, in 1998, the Minnesota Office of Environmental Assistance reported a significant use of pollution prevention measures among the 10 largest managers of toxic chemicals in the state. Four of the 10 facilities achieved an overall reduction in chemical usage through

pollution prevention. Under Massachusetts' Toxics Use Reduction program, reporting facilities reduced toxic waste generation by 48 percent from 1990 to 1998—a decline state officials said could be attributed in part to the greater use of pollution prevention. Data from EPA, state, and industry sources also indicate that pollution prevention has generally taken root to a greater extent among larger facilities than smaller ones.

## Key Factors That Encourage Pollution Prevention

Not surprisingly, companies are more likely to use pollution prevention when it enhances business profitability. Representatives of four of the five firms GAO visited and industry associations GAO contacted said that the opportunity for a significant financial return was among the primary reasons for pursuing pollution prevention. Company officials stated that one key way that pollution prevention improves the bottom line is by reducing production costs. Certain pollution prevention techniques, for example, can help a firm lower its materials cost, improve the efficiency of the production process, or eliminate the costs of treatment and disposal. A printing firm representative, for example, cited his company's use of "direct to press" printing technology, which uses digital technology to replace several steps in the traditional printing process. He said that direct to press technology has not only offered the company cost savings through greater efficiency but has also reduced pollution by (1) rendering unnecessary the use of photographic film, plates, and processing chemicals and (2) reducing wastewater discharges. Companies also identified instances where they avoided having to install expensive pollution control equipment like air stack "scrubbers" by controlling emissions through less expensive pollution prevention techniques, such as switching to cleaner fuels.

Several firms GAO contacted also cited a firm's sensitivity to its community relations and public image as an important incentive to pursue pollution prevention. For example, the Dow Chemical Company's Midland, Michigan facility—in conjunction with the local community, a major national environmental organization, and other concerned parties—agreed to engage in a major pollution prevention experiment. In addition to identifying numerous successful pollution prevention opportunities, Dow officials and environmental representatives agreed that the experiment helped to improve the facility's corporate image.

According to some industry and regulatory officials, the public availability of TRI data is another key factor that prods firms to use pollution prevention to improve community and public relations. TRI contains detailed information on the chemical releases of each reporting facility,

including the number and quantity of toxic chemicals used, waste treatment methods used, and total pounds of each chemical emitted into the environment. As a result, according to company officials, the year-to-year changes in a firm's environmental performance are transparent and fully available to the public.

Environmental laws and regulations can play a key role in promoting pollution prevention in at least two ways. First, some regulations may prompt firms to adopt pollution prevention practices to keep emissions below regulatory thresholds. In some cases this allows them to avoid a potentially costly and time-consuming permitting process; in other cases it precludes the need to install costly emissions control technology. For example, a representative of the Intel Corporation told us that, under a major source air emissions permit, any changes to the production process, including engineering or raw materials changes that might affect emissions, must be reported to the permitting authority so that the facility's permit can be amended—an often time-consuming process. He said that Intel could ill afford such delays, given the fast-paced and competitive nature of the microprocessor industry. To avoid delays, the official said, Intel facilities strive to stay below the threshold of emissions that requires a facility to be regulated as a major source of volatile organic compounds and hazardous air pollutants.

Similarly, regulations may encourage pollution prevention in instances when firm emission standards are set, yet companies are given the flexibility to determine how best to meet such standards. The Clean Air Act's Acid Rain Program, which set stringent performance standards for sulfur dioxide emissions while allowing flexibility on the means of achieving them, serves as a good example of the effectiveness of this approach. Power plants are given the choice of reducing their emissions either by installing "scrubbers" to trap sulfur dioxide before it enters the atmosphere or by switching their fuel from high-sulfur coal to either lower-sulfur coal or natural gas, thereby preventing a portion of the pollutant from being emitted in the first place.[1] By switching fuels, some utilities have reduced their emissions at lower cost than had they purchased and installed scrubbers.

[1]The program also established an allowance trading system that permits electric utilities to trade sulfur dioxide allowances and apply them against their annual emissions. The trading system allows the utilities more flexibility in planning how to achieve the required reductions in emissions and also enables them to minimize the costs of complying with these reductions.

## Key Factors That Discourage Wider Use of Pollution Prevention

GAO's site visits, as well as recent studies, indicate that even after extensive analysis and planning, some pollution prevention measures may pose technical uncertainties and considerable risk. Officials from Kodak Corporation, for example, cited their effort in the 1980s and 1990s to reduce emissions of methylene chloride, a key ingredient used in manufacturing the plastic sheeting that serves as the base of Kodak's photographic film. There were two paths to take to achieve reduced emissions: significant engineering changes to the manufacturing facility, which would reduce emissions through pollution prevention, or the purchase of an "add-on" pollution control device. While the pollution prevention measures met considerable internal resistance within the project team because of concerns about regulatory deadlines, product quality, and the potential for success with the use of pollution prevention techniques, the measures were ultimately taken and proved to be successful. Faced with similar technical uncertainties, however, some companies (particularly smaller companies) have elected not to pursue pollution prevention projects.

In many cases, financial concerns have also been a significant barrier to companies considering whether or not to invest in pollution prevention. Particularly for smaller firms, the up-front capital investment that some pollution prevention measures require may deter a company from changing long-established practices to pursue pollution prevention opportunities. Larger firms may also find the financial threshold for undertaking a pollution prevention project difficult to attain. A Dow Chemical Company official told GAO that to justify undertaking a proposed pollution prevention project, the project's rate of return generally has to exceed the "hurdle rate"—a rate of return at least as great as the return expected of any alternative company investment. Similarly, DuPont officials told GAO that the company's environmental plan included a database containing several thousand potential waste reduction projects. Generally, 80 percent of the mass emissions are from 20 percent of the sources. The firm ranks each project by cost and waste reduction potential. The objective is to achieve for the entire list of proposals 80 percent of the benefit for 20 percent of their total projected cost. Projects falling below this cutoff are generally not implemented.

GAO found broad agreement among industry representatives that while regulatory standards have promoted pollution prevention by compelling industry to lower its overall pollutant releases, certain types of regulations can have the unintended effect of discouraging pollution prevention. In particular, regulations that prescribe the use of specific technologies to meet pollutant limitations can discourage (or preclude) regulated entities

from choosing alternative tools to achieve these limitations—tools that often may include pollution prevention. The Clean Water Act and Clean Air Act, for example, require EPA to establish technology-based discharge rate limits based on "available" or "feasible" emission control technologies. Such standards can discourage pollution prevention in a number of ways, including emphasizing, or even requiring, end-of-pipe compliance solutions instead of process or other pollution prevention solutions. Even in instances when other preventive solutions are not explicitly prohibited, a lack of time, resources, and willingness to accept risk may lead state permit writers to disapprove methods of reducing emissions other than the established control technologies.

To encourage greater consideration of pollution prevention in the development of EPA regulations, the Pollution Prevention Act requires EPA to review its regulatory proposals to determine their effects on source reduction. However, the agency has not systematically tracked its implementation of this provision and therefore does not know the extent to which source reduction has been considered in the promulgation of EPA regulations. According to EPA, anecdotal evidence suggests that such consideration is, at best, inconsistent. While it may be impossible to promote pollution prevention in all agency regulations, GAO concluded that a greater awareness of these practices in the agency's rule-making process could help significantly to further this important national goal.

## Recommendations

GAO recommends that the Administrator, EPA, amend the agency's rule for companies that report toxic releases to its Toxics Release Inventory (1) to clarify reporting requirements so that facilities report their source reduction activities in a consistent manner and (2) to obtain accurate data on the quantity of emissions reduced so that the agency can ascertain the extent and impact of source reduction activities.

GAO also recommends that the Administrator systematically determine the extent of the agency's compliance with the Pollution Prevention Act's requirement that EPA "review regulations of the Agency prior and subsequent to their proposal to determine their effect on source reduction." If warranted by the results of the agency's analysis, GAO further recommends that the Administrator develop a plan to improve the agency's compliance.

## Agency Comments

GAO provided a draft of this report to EPA for its review and comment. Officials from the agency's Office of Pollution Prevention and Toxic

Substances said that overall the report was a balanced characterization of the factors encouraging and discouraging pollution prevention. Among its specific comments, the officials suggested that the report mention the variety of programs and other activities the agency had initiated to promote pollution prevention. While GAO's draft report had touched on several such activities, a fuller discussion of these activities was added to chapter 3. GAO also added a discussion of the role of many state programs in encouraging pollution prevention.

The officials also noted that in characterizing the impacts of its regulations on pollution prevention, it is also important to consider the impacts on pollution prevention of permitting, inspections, enforcement, and other activities associated with the *implementation* of regulations. They further noted that the Pollution Prevention Act encourages consideration of pollution prevention in permitting, inspection, and enforcement; and that consequently, any recommendation concerning the consideration of pollution prevention in the development of regulations should also address the way pollution prevention is taken into account in these implementation-related activities as well. GAO's recommendation focused on EPA's development of regulations because it was that part of the process that was most frequently cited as a disincentive within the regulated community to engage in pollution prevention. That said, GAO acknowledged the value of any EPA effort to encourage greater consideration of pollution prevention in permitting, inspection, and other aspects of regulatory implementation.

Officials from EPA's Office of Environmental Information provided technical corrections to the discussion in chapter 2 relating to the Toxics Release Inventory, which were incorporated into the final report. In addition, GAO provided relevant sections of the draft report to representatives of the companies visited during its review to verify statements attributed to them and other information provided. Their comments were also incorporated into the final report.

# Chapter 1: Introduction

For many years, environmental regulation in the United States has focused on "end-of-pipe" pollution controls to treat, store, and dispose of toxic wastes and other pollutants. This overall strategy, however, has had limited success in reducing the amount of pollution that ultimately enters the environment. For example, a wastewater treatment plant may reduce the amount of hazardous pollutants discharged into a receiving body of water, but the resulting sludge generated by its process may create a hazardous waste that must be disposed in a landfill—in some cases posing continued environmental and health risks. Similarly, other control strategies often result in a similar environmental "shell game" that transfers pollution from one medium to another without actually reducing the amount of pollution entering the environment. Industrial by-products, for example, are often incinerated, but generally not without at least some impact on air quality.

## Increased Focus on Pollution Prevention

In recent years, federal and state regulators, industry, and environmental organizations have devoted increased attention to controlling pollution by avoiding the creation of pollutants in the first place—an approach commonly referred to as pollution prevention. In recognition of this growing emphasis on pollution prevention and the limitations of end-of-pipe pollution controls, in 1990 the Congress enacted the Pollution Prevention Act, which established a national policy that pollution should be prevented or reduced at its source. Under the act, pollution that cannot be prevented should be recycled or treated in a safe manner, and disposal or other releases should be used only as a last resort. The act also directed EPA to develop and implement a strategy to promote source reduction, which the act defined as any practice that (1) reduces the amount of any hazardous substance, pollutant, or contaminant from entering any waste stream or being released into the environment prior to recycling, treatment, or disposal and (2) reduces the hazards to public health and the environment associated with the release. Source reduction includes such practices as modifying equipment, technology, processes, or procedures; redesigning products; and substituting less-toxic raw materials.

Among other things, the act also included a mandate to expand the Toxics Release Inventory (TRI) to include information on source reduction for reporting facilities. Created by the Congress in 1986 under the Emergency Planning and Community Right-to-Know Act, the TRI is an information system to which companies report annually to EPA and the states on their facilities' estimated releases of hundreds of chemicals. The Pollution Prevention Act requires each facility submitting information to the TRI to report (1) the quantity of toxic chemicals entering any waste stream prior

to recycling, treatment, or disposal, (2) a comparison showing the ratio between a firm's current chemical production or use and the facility's previous report, and (3) the source reduction practices used, if any, to reduce chemical waste. EPA compiles the data and makes them available to the public.

## Objectives, Scope, and Methodology

Interested in the potential for U.S. industry to make greater use of pollution prevention activities, Congressmen Boehlert, Dooley, and Greenwood asked us to (1) examine the extent to which companies are employing pollution prevention strategies, (2) identify the major incentives encouraging companies to use pollution prevention strategies, and (3) identify the major disincentives that discourage their use of pollution prevention.

To determine the extent to which companies employ pollution prevention strategies, we analyzed quantitative data available from EPA and other sources on companies' pollution prevention practices, interviewed representatives of relevant national organizations, and reviewed existing literature on the subject. Our primary data source was EPA's Toxics Release Inventory, which agency officials cited as the most comprehensive source of information available on pollution prevention practices nationwide. We did not perform an independent test of the data's accuracy and completeness, but did obtain information on these matters from EPA Headquarters officials. We also examined data from several individual states, including Massachusetts, Minnesota, and New Jersey, which experts had identified as leaders both in promoting pollution prevention practices and in measuring the extent of implementation within their jurisdictions.

We supplemented these data with interviews of officials representing EPA, state environmental agencies, independent research groups such as the Environmental Law Institute, environmental organizations such as the Natural Resources Defense Council, and industry organizations such as the Business Roundtable and the American Chemistry Council. We also reviewed existing literature that addresses the extent to which pollution prevention strategies have been employed.

To identify major incentives and disincentives affecting companies' use of pollution prevention, we interviewed representatives of the organizations noted above, and reviewed published literature addressing these issues. To obtain more detailed insights, we also conducted site visits to several firms that had employed pollution prevention measures. In selecting the firms,

we considered a number of factors to help ensure that we would obtain information on diverse pollution prevention experiences. Accordingly, we included several different industries, such as chemical manufacturing, microprocessor manufacturing, and printing firms. We also visited large, diverse firms such as the DuPont, Kodak and Intel corporations, as well as a smaller local facility (a Minnesota printing company). In making our selections, we also sought to visit firms from different states in order to identify what effect, if any, state pollution prevention policies had on the firms' pollution prevention practices.

During our site visits to these firms, we sought to obtain detailed information concerning their decisions whether or not to pursue pollution prevention, specific process or input changes implemented, the environmental results of pollution prevention measures taken, and the cost impacts associated with these measures. We supplemented these visits by following up with other companies whose pollution prevention practices had already been documented by other organizations. Dow Chemical Corporation was among the companies that had recently undertaken significant pollution prevention efforts at its La Porte, Texas and Midland, Michigan facilities.

We conducted our work from June 2000 through January 2001 in accordance with generally accepted government auditing standards.

# Chapter 2: Some Companies Have Implemented Pollution Prevention But Full Extent is Unknown

Limited quantitative data exist regarding the extent to which U.S. companies have implemented pollution prevention measures. According to EPA, the agency's Toxics Release Inventory (TRI) database—while far from a complete record on the subject—contains the most comprehensive information of any source regarding both the type and extent of pollution prevention methods in use. GAO analysis of TRI data showed that in each year from 1991 to 1998, one-fourth to one-third of reporting firms implemented at least one pollution prevention measure. Other information supplied by EPA, as well as studies from individual states and other sources, also documented the extent to which individual companies have adopted pollution prevention techniques. This information was supplemented by our contacts with industry participants, regulators, and analysts, who conveyed a consensus that many additional opportunities exist for companies to use pollution prevention in finding cost-effective opportunities to meet environmental requirements.

## Limited Quantitative Data on the Extent of Pollution Prevention Implementation

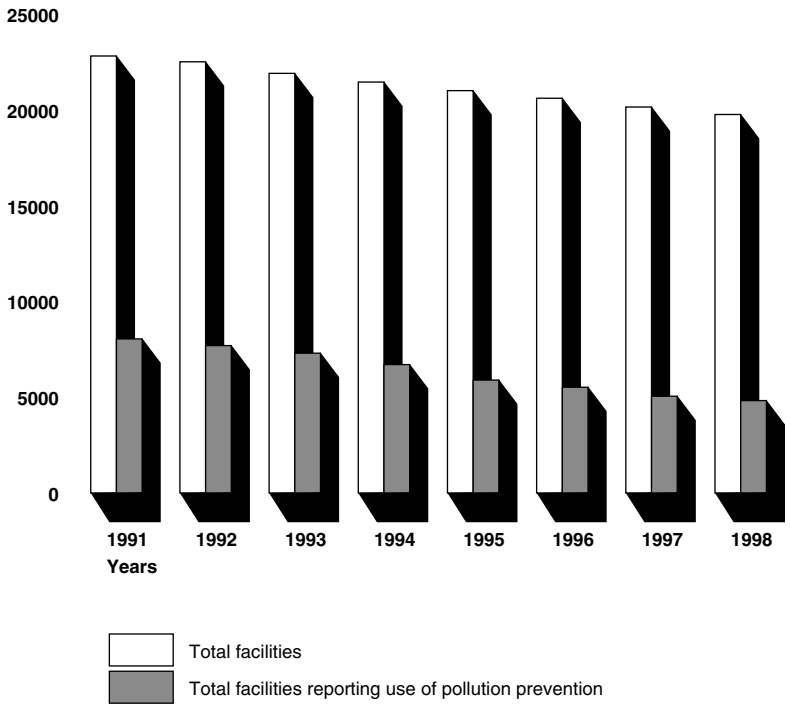
Quantitative data on the extent to which companies have implemented pollution prevention efforts are limited, and national data on emissions reduced through pollution prevention measures do not exist. Data from EPA's TRI indicate that in each year between 1991 and 1998, approximately one-quarter to one-third of reporting facilities implemented at least one pollution prevention measure. Good operating practices, such as improved facility maintenance and production process modifications, were the most common types of pollution prevention measures reported. Other EPA data, as well as analyses by individual state environmental agencies and other organizations, also documented pollution prevention efforts of specific industry sectors.

### TRI Data on the Use of Pollution Prevention

Since 1987, industrial facilities have been required to report annually to the TRI on the types of chemicals they use and manufacture, as well as the amounts of these chemicals that are being released into the environment or otherwise managed as waste. Since the passage of the Pollution Prevention Act of 1990, these facilities have also been required to report on their efforts to prevent or reduce pollution at the source. As a result, since 1991, the TRI has collected information on the number and type of such source reduction activities implemented, as well as quantities of chemicals recycled, combusted for energy recovery, and treated on and off site.

GAO's analysis of TRI data reveals that in each year from 1991 through 1998, approximately one-quarter to one-third of facilities reported implementing at least one pollution prevention activity.

**Figure 1: Facilities Reporting Pollution Prevention Activities to TRI from 1991 through 1998**




Source: GAO analysis of TRI data.

While figure 1 appears to show a steady decline in the number of facilities engaged in pollution prevention activity, this does not necessarily indicate a decline in the use or impact of pollution prevention measures. EPA notes, for example, that companies may have launched their pollution prevention efforts by focusing on a large number of simple activities and have since moved on to larger, more complex activities. This could have led to a decrease in the number of activities undertaken, while the amount of effort devoted to pollution prevention may have remained undiminished. Furthermore, the decline in the number of facilities reporting pollution prevention does not necessarily reflect a decline in the amount of emissions reduced through such efforts. Finally, pollution prevention efforts are not discrete events with an impact at only one point in time, but tend to have ongoing emissions reduction effects once implemented. Therefore, if a company undertakes a pollution prevention

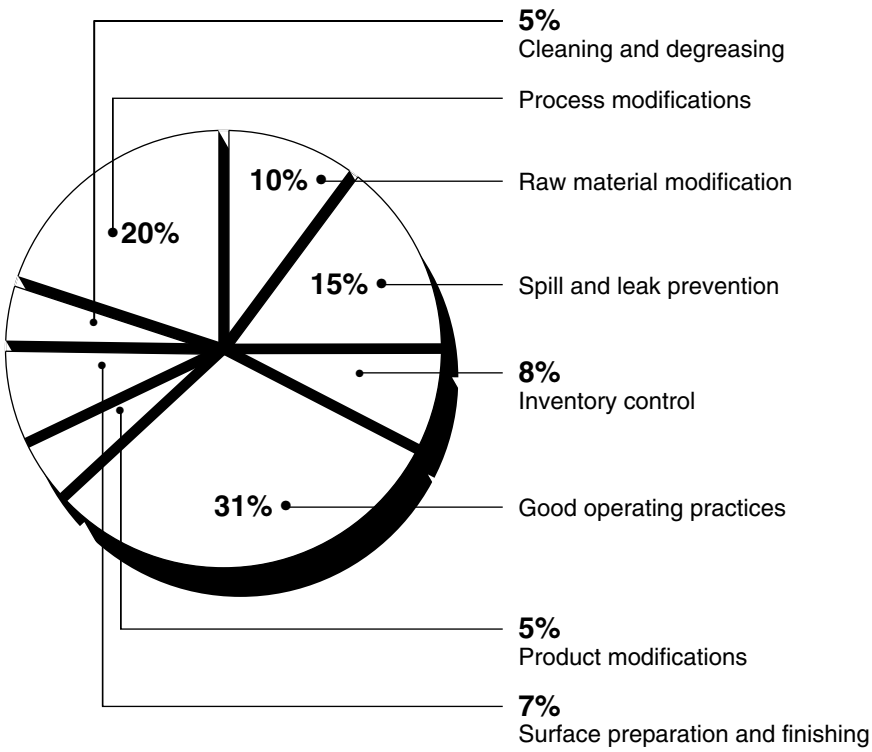
measure, such as substituting a non-toxic material for a toxic substance in a production process, it is likely that the decrease in emissions will carry through to subsequent years, but that the continuing impact of the measure will go unreported.

We also identified the total number of facilities that reported implementing pollution prevention over the course of the 8-year period. About half of the facilities reported implementing at least one pollution prevention measure during this period.

TRI also requires industrial facilities that report pollution prevention activities to identify the types of strategies they use. Over the 8-year period, good operating practices—such as covering solvent tanks when not in use to minimize evaporation or improved maintenance scheduling—were by far the most common type of pollution prevention approach, implemented in over 57,000 reported instances.[1] Process modifications — the second most commonly implemented category of pollution prevention—were cited in over 40,000 instances. Process modifications can include installing a new catalyst in a process that substantially reduces the generation of a pollutant, or modifying production equipment and piping in a way that generates less waste. Product modifications, such as changing product design, specifications, or packaging, were the least common form of pollution prevention—implemented in about 10,000 instances. Figure 2 illustrates the frequency at which facilities implemented the different categories of pollution prevention practices in 1998. This distribution remained relatively consistent in each year during the 8-year period we examined.

[1]This figure may include some degree of double counting. Facilities submit a separate TRI form for each toxic chemical they report, and the same pollution prevention measure may have addressed more than one chemical. Hence, a single instance of a pollution prevention activity may have been reported two or more times.

**Figure 2: Types of Pollution Prevention Activities Reported in 1998**




Note: The percentages in this figure do not add to 100 percent due to rounding.

Source: GAO analysis of TRI data.

There are several limitations to drawing broad conclusions from TRI data. Facilities with fewer than 10 full-time employees are not required to report to TRI. As a result, small facilities are excluded from reporting their emissions even though they may collectively contribute a significant amount. Secondly, only certain industries are required to report. Chemical manufacturers, printers, and electric utilities must report while dry cleaners and automotive repair shops, for example, have no obligation to do so.[2] Finally, while hundreds of chemicals are reported to TRI, many pollutants of concern, such as sulfur dioxide and nitrogen oxide emissions

[2]EPA has expanded the list of industries required to report over the years. For example, metal mining and coal mining were added in 1998.

from power plants or nutrients from wastewater treatment plants, are not covered. Moreover, the chemicals that are covered must be reported only if the amount of discharge exceeds a specified threshold.

Another key limitation of TRI data is the potentially inconsistent and incomplete manner in which companies report to the TRI. As EPA officials noted, the guidance for reporting source reduction activities to the TRI is ambiguous, and may result in inconsistencies in reporting. For example, some facilities may report a source reduction activity only in the year it was implemented, while other facilities may report the same activity year after year. In addition, TRI gives no indication of the quantitative impact of pollution prevention activities. EPA's guidance on the TRI reporting requirements states only that facilities must report on source reduction activities. It does not require companies to report the quantity of emissions reduced through these activities. Without data on the quantity of emissions reduced, it is difficult to draw conclusions about the extent and impact of source reduction activities.

EPA officials told us that the agency is considering ways to address some of these limitations through rulemaking. The agency's effort could include definitions and guidance to assist companies in filling out the sections applicable to source reduction activities. For example, the new rule could address how facilities should report pollution prevention initiatives that have an impact over a multi-year period. This rule would also help to ensure that the data collected are more consistent across facilities. In addition, EPA may also add additional reporting elements, such as the quantity of toxic chemicals reduced due to source reduction activities. EPA officials stated that this information would help them estimate the progress of source reduction, which in turn would help them better target their efforts.

## Other Studies Also Document Use of Pollution Prevention

A variety of studies and other sources provide additional information on industry's use of pollution prevention, supplementing EPA's TRI data. These sources tend to focus on specific industries or activities within specific states. Some suggest that implementation of pollution prevention may be somewhat broader than that implied by the TRI data. For example, a draft 1997 EPA study on lithographic printers and larger manufacturing companies found the implementation of pollution prevention activities to

be fairly widespread, especially among larger firms.[3] Overall, 85 percent of the 516 production officials for large manufacturers contacted reported implementing pollution prevention measures, with the implementation of good operating practices and modifications to the production processes being the most common types. In general, larger facilities—as measured by the number of production employees per shift—were more likely to pursue pollution prevention than smaller ones.

According to EPA, several factors may account for the differences between TRI data and the findings of its 1997 report. First, the study focused on larger manufacturing firms that, as discussed in the last section of this chapter, may have a greater tendency to engage in pollution prevention than smaller firms do. Second, the data were obtained through interviews with production-line officials and not corporate environmental officials. These individuals, who make the day-to-day decisions, tend to have the best knowledge about pollution prevention activities. Finally, the questions in the survey did not focus specifically on environmental issues, but covered a wide range of factors. By interviewing production-line officials and avoiding the use of environmental nomenclature, this study may have revealed "pollution prevention" efforts that were not recognized as such by the implementing facilities.

In addition to EPA, a number of states have also undertaken studies that shed some light on pollution prevention activities within their jurisdictions. For example, the Minnesota Office of Environmental Assistance published a report in 1998 that indicated significant use of pollution prevention among the 10 largest managers of toxic chemicals in the state. As table 1 indicates, 9 of the 10 facilities reduced the use of two or more chemicals through pollution prevention techniques. In addition, 4 of the 10 facilities achieved an overall reduction in chemical usage through pollution prevention. In some cases, the reductions were quite significant. For example, the 3M-Cottage Grove facility reduced 17 of 32 chemicals, and reduced the total chemical usage from about 26 million pounds to about 14 million pounds. At 5 of the 10 facilities, however, reductions in the use of some chemicals were more than offset by greater use of the remaining chemicals. For example, although the Ashland Petroleum Company substantially reduced its use of phosphoric acid and ammonia,

[3] *Study of Industry Motivations for Pollution Prevention* (Draft report). U.S. EPA Pollution Prevention Policy Staff, April, 1997

total use of toxic chemicals rose from 1.1 million in 1995 to 2.6 million pounds in 1996.

**Table 1: Pollution Prevention and Chemical Use at the Ten Largest Users of Toxic Chemicals in Minnesota, 1995 to 1996**

| Facility | Number of TRI Chemicals Used or Produced | Number of TRI Chemicals Reduced through Pollution Prevention | Did Facility Achieve a Net Reduction In TRI Chemical Discharges? | Example of Techniques Used |
|---|---|---|---|---|
| **3M-Hutchinson** Tape manufacturing plant | 16 | 9 | Yes | Solvent recovery |
| **3M-Cottage Grove** Hazardous waste incinerator | 32 | 17 | Yes | Changes in operating practices |
| **Boise-Cascade** Paper mill | 9 | 2 | No | Spill and leak prevention |
| **Potlach Corporation** Paper manufacturer | 8 | 5 | No | Re-circulation within a process |
| **North Star Steel** Steel manufacturer | 8 | 5 | Yes | Increase purity of raw materials |
| **3M Company** Consumer products | 14 | 10 | No | Modified product design/composition |
| **Ashland Petroleum** Oil refinery | 21 | 7 | No | Improved loading procedures |
| **Koch Refining Co**. Chemical refining | 32 | 17 | No | Improved storage |
| **Sheldahl Inc**. Printed circuitry and other electronics | 9 | 6 | Yes | Substituted raw materials |
| **Mixon Inc.** Metal casting factory | 1 | 0 | No | Modified equipment |

Source: 1998 Pollution Prevention Evaluation Report, Minnesota Office of Environmental Assistance, February 1998.

The Massachusetts Toxics Use Reduction Act established the prevention of pollution at the source as the state's top priority in pollution control. Data from the Massachusetts Toxics Use Reduction Program indicate the extent to which facilities have reduced toxic emissions through pollution prevention. Adjusted for changes in production,[4] reporting facilities reduced toxic waste generation by 48 percent from 106 million pounds in 1990 to 55 million pounds in 1998. Although other factors may have contributed to this decline (e.g., substituting a toxic chemical for another

[4]Because chemical use can fluctuate with production levels, Massachusetts adjusts its data on toxic chemical use to account for changes in production, so that the effects of source reduction activities can be compared from year to year.

similarly toxic chemical not on the list), state officials said that a substantial portion of the decline could be attributed to pollution prevention efforts. A 1997 study of the state Toxics Use Reduction Program reported that 351 of 434 surveyed facilities (81 percent) stated that they had, or would, implement pollution prevention projects identified in their toxics use reduction plans. Finally, in-depth studies at 22 selected facilities found that each facility had implemented one or more pollution prevention measures since 1990, although the intensity of the efforts varied from firm to firm. Several firms had mounted aggressive efforts to eliminate the use of toxic chemicals while others had reported more limited efforts, such as modifying a single production process or reducing the generation of a specific chemical.

## Regulators and Other Knowledgeable Sources Agree that Additional Pollution Prevention Opportunities Exist

Given the relative paucity of complete and reliable quantitative information on the extent of pollution prevention activities nationwide, we interviewed a range of knowledgeable parties, including federal and state environmental officials, industry association representatives, and environmental representatives. These officials concurred with recent studies on the subject that had found that although some progress had been made in implementing pollution prevention during the past 10 years, significant opportunities have not been realized. Their comments also revealed a strong consensus that larger firms had made significantly more progress in institutionalizing pollution prevention than smaller firms.

The state pollution prevention officials we interviewed concurred that while pollution prevention has received greater attention during the past decade, substantial opportunities exist for pollution prevention across a range of industries that could provide cost-effective ways to meet environmental requirements. For example, a representative of the New Jersey Department of Environmental Protection said that not only is "low hanging fruit" going unpicked, some is "rotting on the ground." She noted that there are tremendous opportunities, including ones that companies could implement with little difficulty. The New Jersey official added that almost all facilities could identify pollution prevention opportunities in the pollution prevention plans they submit to the state, even if they are not implementing the measures. Similarly, a representative from the Illinois Office of Pollution Prevention remarked that state engineers rarely visit a facility without finding fairly simple pollution prevention opportunities to suggest.

This perception is consistent with the data published in a 1998 Business Roundtable report.[5] The report stated that despite significant company experience with pollution prevention, the concept remains timely for manufacturers it surveyed. Seventy-eight percent of facilities responding to a Roundtable survey stated that undiscovered pollution prevention opportunities exist in their manufacturing operations, while 95 percent of respondents stated that new opportunities would likely emerge in the next three years.

State officials also stated that larger firms had generally made the greatest progress in implementing pollution prevention measures. For example, an official from Virginia's Department of Environmental Quality explained that large companies such as Ford, Merck and DuPont have taken significant advantage of pollution prevention opportunities. This view was supported by a representative of New York's Department of Environmental Conservation, who stated that smaller firms were generally less aware of pollution prevention measures than larger firms were, or less able to implement them. She underscored the potential environmental significance of the problem by citing the state's metal finishing industry, which, she indicated, was composed mainly of small to medium firms that generally did not pursue pollution prevention. She further noted that these facilities emit metals and other pollutants that the state has identified as priority pollutants for reduction. Almost all of the other state environmental representatives we interviewed reported similar disparities in the approaches toward pollution prevention that exist between large and small firms.

EPA's draft 1997 study highlighted this disparity between large and small firms, as did the industry representatives we interviewed. For example, the EPA study found that 90 percent of firms with 100 or more employees on the average shift had reported implementing pollution prevention measures, whereas 76 percent of facilities with between 1 and 19 production employees per shift had implemented pollution prevention. Similar results were found for a sample of 520 lithographic printing companies. We were also told repeatedly by representatives of the chemical and electronics industries that a limited number of large firms in those industries tended to be the most aggressive, while smaller firms

[5] *A Benchmarking Study of Pollution Prevention Planning: Best Practices, Issues, and Implications for Public Policy*, The Business Roundtable Environment Task Force, August 1998.

were less aggressive. The representative of the electronics industry noted that the reluctance of smaller firms in that industry to pursue pollution prevention has had an industry-wide impact because the manufacture of printed wiring boards is largely dominated by small firms. These views were echoed in a 1999 study by the Environmental Law Institute (ELI), which noted that industries dominated by small business lack both the technical and financial capacity to conduct the necessary research efforts to identify new opportunities. Among other industries, ELI cited the example of the dry cleaning industry as one that is "dominated by very small firms and where the industry has financed little research on alternative processes."[6]

## Conclusions

Limited quantitative data exist on the extent to which American industry has sought to use pollution prevention methods to reduce pollutants discharged from its facilities. Nonetheless, targeted studies conducted by individual state agencies and other organizations and a widespread consensus among industry participants, regulators, and analysts strongly suggest that additional cost-effective opportunities exist for pollution prevention that could help companies fulfill their environmental requirements.

EPA officials noted that gaps exist in the information facilities report on their efforts to reduce toxic releases. They noted in particular that ambiguities in the agency's guidance on how facilities report source reduction activities to the TRI may result in inconsistencies in how this requirement is addressed from facility to facility. In addition, TRI reports do not provide accurate information on the quantity of emissions reduced from source reduction activities. As agency officials acknowledged, revising the EPA guidance could both improve the accuracy of TRI reporting and help the agency to better target its own efforts to further encourage pollution prevention.

## Recommendation

We recommend that the Administrator, EPA, amend the agency's rule on the way companies report toxic releases to TRI to (1) clarify reporting requirements so that facilities report their source reduction activities in a

[6]Environmental Law Institute, *Innovation, Cost and Environmental Regulation: Perspectives on Business, Policy and Legal Factors Affecting the Cost of Compliance* (May 1999: Washington D.C.), p. 19.

consistent manner and (2) obtain accurate data on the quantity of emissions reduced so that the agency can ascertain the extent and impact of source reduction activities.

# Chapter 3: Key Factors Affecting the Use of Pollution Prevention Techniques

A number of factors affect companies' decisions as to whether and how they will pursue pollution prevention. The key incentives that encourage companies' use of pollution prevention tend to be economic in nature; a company is more likely to use such practices when they enhance its business profitability by making its processes more efficient. Other key factors that affect companies' decisions include the prospect that pollution prevention could improve a company's public or community image; regulations that encourage reductions in allowable pollutant discharges (particularly those offering companies the flexibility to choose how to achieve such reductions); and the proliferation in recent years of business strategies that incorporate more comprehensive environmental management tools.

Major impediments to the wider use of pollution prevention include (1) the technical challenges associated with new and sometimes unproven techniques, (2) decisionmakers' tendency to rely on methods that are "tried and tested" and to avoid risks that could expose a company to loss, (3) concerns over a potentially unfavorable rate of return (particularly when compared with alternative investments under consideration), and (4) regulations that prescribe a specific technology or method to meet pollutant limitations, thereby discouraging or precluding the use of alternative means of achieving necessary reductions.

## Factors That Encourage Pollution Prevention

### Enhancing Business Profitability

Pollution prevention can offer firms a variety of financial benefits, including lower costs for materials and more efficient processes. Representatives of 4 of the 5 firms we visited and each of the industry associations we contacted said that the opportunity for a significant financial return, either by reducing production costs or by enhancing revenues, was among the primary reasons for pursuing pollution prevention.

The prospect of reduced production costs has been recognized as a potential benefit of implementing pollution prevention measures. As EPA noted in 1992, pollution prevention techniques can help a firm lower its

materials cost, improve the efficiency of the production process, or eliminate the costs of treatment and disposal.[1] A firm may reduce materials costs by eliminating a particular ingredient or chemical, finding a less-polluting raw material, or making adjustments to the production process resulting in lower waste generation. In such cases, the cost of raw materials and waste per unit of output may decline. For example, the cost of materials can be reduced by production and packaging changes that consume fewer resources, and thus result in less waste.

This point was further emphasized in our interview with a printing firm representative, who characterized the printing industry as one comprised of many small firms with narrow profit margins that are intensely competitive. He noted that with profit margins of about 6 percent, it takes about $450,000 in new sales to realize $25,000 in additional profits. Therefore, a successful pollution prevention practice that reduced costs could potentially add to the firm's bottom line in a way that would be difficult to achieve through increased sales. He also noted that pollution prevention has sometimes been the indirect result of a production innovation undertaken for non-pollution related financial reasons. As an example, he cited "direct to press" printing technology, which uses digital technology to supplant several steps in the traditional printing process. He said that direct to press technology has not only offered the company cost savings through greater efficiency, but has also reduced pollution by (1) rendering unnecessary the use of photographic film, plates, and processing chemicals and (2) reducing wastewater discharges.

Firms can also realize cost savings by substituting a cleaner, less-costly material for a polluting chemical. For example, a National Pollution Prevention Roundtable report identified an automobile parts manufacturer that switched from a methanol-based adhesive to a water-based adhesive to bond rubber and metal parts.[2] This practice reduced methanol consumption at the facility from 240 to 24 drums per year, and consequently diminished emissions of volatile organic compounds by 38 tons. As a result, the facility achieved operating savings of $21,000 annually.

[1]Environmental Protection Agency, *Facility Pollution Prevention Guide*, May 1992.

[2]National Pollution Prevention Roundtable, *A Global Pollution Prevention Compendium: Case Studies and Legislative Efforts* (Fall 1998).

We also found instances in which pollution prevention techniques helped firms avoid the costs of installing emissions control technology. Officials at the DuPont Company cited one of their facilities that produces titanium dioxide—a white pigment that gives opacity to products such as toothpaste and paint. The emissions from the titanium dioxide manufacturing process included sulfur dioxide and carbonyl sulfide. While the facility had to install a stack scrubber to capture the sulfur dioxide emissions, it was able to control 90 percent of its carbonyl sulfide emissions through use of pollution prevention techniques. According to DuPont officials, the company saved about $5 million at a single facility by avoiding the need to install carbonyl sulfide control equipment, and has since chosen to implement the same pollution prevention approach at five other facilities.

## Improving a Firm's Community Relations and Public Image

According to the representatives of several firms and the industry trade associations we contacted, a key incentive to engage in pollution prevention is its potential to (1) improve a firm's relationship with the communities in which industrial facilities are located and (2) cultivate a corporate image as a good environmental steward. For example, maintaining good relations with local community activists was one of the chief reasons the Dow Chemical Company pursued the Michigan Source Reduction Initiative—an extensive effort to identify and implement pollution prevention measures at Dow's facility in Midland, Michigan. A Dow official noted that the Midland facility had a long history with local activists and non-governmental groups. He said these activists were well informed about Dow's plant and activities in Midland, and once Dow came up with the overall goal of cutting waste by 50 percent, these activists came up with a list of chemicals for Dow to reduce. He noted that Dow officials might have picked different focus areas had they taken their preference, but they focused instead on the priority areas the activists had selected.

According to industry and regulatory officials, the public availability of TRI data provides an additional strong incentive to use pollution prevention techniques in a way that enhances its community relations and public image. They noted that since TRI contains such detailed information about reporting facilities' use and release of toxic chemicals, the year-to-year changes of a firm's environmental performance are transparent and are fully available to the public.

An official in Minnesota's Office of Environmental Assistance agreed that the public availability of these data has been a huge motivator for

pollution prevention, and advocated that EPA strengthen its efforts to publicize and enhance the public's access to TRI data. Industry officials also pointed to the public availability of TRI data as a key factor affecting their community and public relations and therefore their incentive to minimize discharges of TRI pollutants. A representative of DuPont said that emissions reduction through pollution prevention remained a major corporate goal in his firm, which had, at one time, been the largest emitter of toxic substances under TRI. The Minnesota printing company representative said that his firm specifically sought to reduce its overall volume of TRI chemicals below the threshold at which it must be reported.

Other officials applauded programs that provide public recognition to firms that minimize their discharges through pollution prevention. Several pointed specifically to EPA's 33/50 Program as a key impetus for engaging in the practice. Begun in 1991, the program challenged firms to voluntarily reduce their releases and transfers of 17 priority chemicals 33 percent by 1992, and 50 percent by 1995. Several industry and regulatory officials told us that the 33/50 Program was a major spur for voluntary pollution prevention activities. For example, a DuPont official stated that meeting the goals of the 33/50 Program had had a significant public relations benefit for the company, and the firm met its obligations largely through pollution prevention rather than end-of-pipe controls. According to EPA, TRI data also indicate that the 33/50 Program encouraged pollution prevention. Specifically, a March 1999 report on the 33/50 Program showed that participating facilities reported more pollution prevention activities for the 17 priority chemicals under the 33/50 Program than for other toxic chemicals reported to the TRI.

## Complying With Environmental Laws and Regulations

Environmental laws and regulations can promote pollution prevention in a number of ways. First, firms may adopt pollution prevention in order to keep emissions below regulatory thresholds. By taking these steps, they may avoid a potentially costly and time-consuming permitting process, and possible requirements to install costly emissions control technology. For example, a representative of the Printing Industries of America explained that a facility could be subject to significant regulatory requirements if its emissions exceed the regulatory threshold for a pollutant, such as volatile organic compounds. Accordingly, he said, many printing firms implemented pollution prevention measures to keep their emissions below these thresholds. He indicated, for example, that to stay beneath the "major source" threshold, some firms have substituted other chemicals for isopropyl alcohol, which leads to volatile organic compound emissions.

Similarly, an Intel representative told us that the Clean Air Act's requirement that major sources obtain federal permits is a major driver for pollution prevention efforts at the company's chip-making facilities. He said that under a major source permit, any changes to the production process, including engineering or raw materials changes that might affect emissions, must be re-permitted. He said that Intel can ill afford such delays, given the fast-pace and competitive nature of the microprocessor industry. Accordingly, the official said, Intel facilities continue to strive to stay under the threshold of being regulated as a major source of volatile organic compounds and hazardous air pollutants.

Pollution prevention can also be encouraged by regulations and policies that set firm emission standards for firms and industries, but allow firms flexibility in how to meet such standards. For example, under its Project XL and its Pollution Prevention in Permitting Program, EPA has offered facilities operational flexibility in exchange for a commitment to maintain emissions under a specific ceiling. In one XL project, a Merck Pharmaceuticals plant in Virginia agreed to facility-wide caps on emission of several air pollutants in exchange for the right to make process and equipment changes without going through the permit review process. Under this program, Merck converted its boiler at the facility from coal to natural gas, thus achieving a 94-percent reduction in sulfur dioxide emissions.[3]

The Clean Air Act's Acid Rain Program serves as another example of a flexible regulatory approach. It has encouraged pollution prevention by setting stringent performance standards while allowing companies the flexibility to decide the best means of achieving them. The program requires electric power plants to reduce their sulfur dioxide emissions, by choosing either to reduce their emissions by installing "scrubbers" to trap sulfur dioxide before it enters the atmosphere or by switching their fuel from high-sulfur coal to either lower-sulfur coal or natural gas, thereby preventing a portion of the pollutant from being emitted in the first place.[4]

[3]National Academy of Public Administration, *Environment.gov: Transforming Environmental Protection for the 21st Century*, November 2000.

[4]The program also established an allowance trading system that permits electric utilities to trade sulfur dioxide allowances and apply them against their annual emissions. The trading system allows the utilities more flexibility in planning how to achieve the required reductions in emissions and also enables them to minimize the costs of complying with these reductions.

By switching fuels, the utilities can sometimes reduce their emissions at lower cost than if they had purchased and installed scrubbers.

A recent study prepared for EPA shows that many utilities have, in fact, exercised their flexibility to employ the preventive fuel-switching approach to achieve their required reductions.[5] Specifically, between 1995 and 1997, fuel switching accounted for 63 percent of the total sulfur dioxide emissions reduced under the program.

The benefits from this preventive option were underscored by environmental officials at Dominion Virginia Power, who told us that the flexibility under the program to switch to low-sulfur coal has the potential to save them millions of dollars at a single power plant. Specifically, the company is evaluating the feasibility of using imported, low-sulfur coal to reduce sulfur dioxide emissions sufficiently to avoid the use of stack scrubbers at the company's Mount Storm power plant in West Virginia. Company officials estimated the cost to add the three scrubbers to be roughly $300 million.

Pollution taxes serve as an alternative regulatory approach that offers strong financial incentives, rather than a strict mandate, to reduce pollution. They also offer the flexibility to reduce pollution using techniques, including pollution prevention, that go beyond conventional pollution control. Under this approach, emission charges are levied on the discharge of pollutants into the environment, and product charges are levied on products deemed harmful to the environment when produced, used, or disposed of. Thus, for example, taxing each pound of a facility's air pollutant emissions may give that facility an incentive to find ways to prevent emissions in the first place. Generally, a pollution tax gives firms an incentive to reduce pollution as long as the tax remains higher than the cost of controlling the pollution. As polluters seek new ways to lower their taxes by reducing pollution, the approach provides them both the flexibility and the incentive to experiment with technical innovation, including the development and use of pollution prevention techniques.

Finally, EPA officials pointed out that strong incentives to engage in pollution prevention might result not just from laws and regulations themselves, but from the compliance process associated with the

[5]A.D. Ellerman, P.L. Joskow, R. Schmalensee, J.P. Montero, and E.M. Bailey, *Markets for Clean Air: The U.S. Acid Rain Program.*

regulations. For example, EPA policy encourages pollution prevention when negotiating enforcement settlements with industrial facilities that have committed violations. During the settlement process, EPA uses two basic avenues to promote pollution prevention. First, the agency may require the respondent/defendant to use pollution prevention methods to redress the original violation and to achieve compliance.[6] Second, EPA and the respondent/defendant may agree to the inclusion of a Supplemental Environmental Project (SEP) as part of a settlement agreement. Under an SEP, the respondent/defendant agrees to conduct one or more projects that reduce risks posed to human health and the environment beyond what the law requires. SEPs are not designed to redress the original violation, but rather to mitigate the size of an assessed penalty. According to EPA, innovative pollution prevention approaches have been used in undertaking SEPs.

## Implementing Environmentally-Friendly Business Practices

In recent years, American industry has engaged in an increasing number of business practices that promote a more systematic and thorough approach to environmental protection. While these practices may not have been designed to promote pollution prevention, they nonetheless create an environment in which pollution prevention measures have a greater chance of being adopted.

One important example involves the use by a growing number of companies of environmental management systems (EMSs). EMSs are intended primarily to ensure that facilities are in full compliance with applicable regulations. However, they also routinely encourage firms to go beyond compliance, focusing on ways a facility can continue to improve its environmental performance. Of particular note, according to an international standard for environmental management systems,[7] firms adopting a management system are to identify all facility operations and processes that have negative environmental impacts, evaluate the

[6]In the absence of statutory, regulatory, or permit language, members of the regulated community are free to choose how to comply. However, once a civil or administrative action has been initiated, the specific means of returning to compliance are subject to administrative or judicial orders, and/or mutual agreement between EPA and the respondent/defendant. As part of this process, pollution prevention compliance methods can be utilized along with more traditional end-of-pipe compliance methods.

[7]Developed by the International Organization for Standardization, this standard is commonly referred to as ISO 14001.

significance of the impacts, and set objectives and targets for reducing these negative impacts.

A 1998 analysis by the National Pollution Prevention Roundtable found that the ISO 14001 standard's emphasis on involvement of top-level management and a systematic approach to environmental management could encourage the use of pollution prevention.[8] This finding was substantiated when the regulatory and industry officials we interviewed indicated that a facility that adopted an environmental management system would be more likely to pursue future pollution prevention opportunities. For example, in exchange for granting flexibility in the state's environmental permitting process, Oregon's Green Permits Program requires participating firms to adopt an EMS, with the expectation that this would move facilities to systematically identify, monitor, and reduce environmental impacts. A representative of the Oregon Department of Environmental Quality said the adoption of management systems is beneficial, because it is one way to get businesses to think about their processes—the first important step in pollution prevention. Similarly, an official with the Wisconsin Electric Power Company noted that the company routinely conducts environmental audits of its facilities, primarily to ensure their compliance with environmental requirements. According to the official, however, these audits identify pollution prevention opportunities as well.

Environmental cost accounting can be an important element of an EMS. According to EPA and others, the full costs of a firm's environmental impacts are often obscured by traditional accounting systems. Such systems often obscure such items as the costs of obtaining an environmental permit, evaluating alternative pollution control equipment, and training employees. In addition, intangible costs, such as the costs a facility incurs in maintaining a good relationship with customers and the host community, may not be recognized as environmental costs. Instead of explicitly recognizing such costs, firms often allocate them to other categories such as overhead, and research and development. A 1998 analysis by Resources for the Future noted a widespread belief that sound environmental accounting will help firms identify and implement

[8]The National Pollution Prevention Roundtable is a national organization of officials representing state, local, and tribal pollution prevention programs. The analysis also noted several drawbacks to the ISO 14001 standard as it pertains to pollution prevention.

financially desirable environmental innovations, such as pollution prevention.[9]

Some firms, such as Kodak, have used a technique known as life cycle assessment that, in effect, promotes pollution prevention in the design of products. Life cycle assessment is primarily a tool for assessing the environmental impact of a product or a material through its entire life cycle, including the impacts of raw material extraction and processing, manufacturing, distributing, product use, recycling, and disposal. For each stage of the life cycle, analyses are performed on a wide range of environmental and health impacts, such as energy consumed in product manufacture or use; impacts of raw material utilization; the emissions occurring as a result of processing or manufacture; and the prospects for recycling or reusing the product. A representative of Kodak told us that the firm had used life cycle analysis to compare the environmental impact of 3 alternative designs for its one-time-use cameras. In this case, the scope of the assessment was limited to raw material extraction and manufacturing of the camera body and associated electronics. Analysts assessed the alternatives' impact on a wide array of environmental indicators, including energy use, ozone depletion, and air and water toxicity. In the end, one alternative proved to be superior to the other two alternatives for all indicators. As a result, according to the Kodak official, the pollution was minimized in the design phase of the camera.[10]

## EPA and State Pollution Prevention Programs

In addition to the incentives discussed above, EPA has initiated a number of programs and other activities to promote the wider use of pollution prevention. One example is the Design for the Environment Program, in which the agency enters into partnerships with industry sectors to develop products, processes, and technologies that have been designed with environmental considerations in mind. One goal of the program is to encourage the use of pollution prevention to reduce potential risks to human health and the environment as an alternative to relying solely on end-of-pipe controls. EPA's Environmental Accounting Project encourages

[9] *The Benefits of Improved Environmental Accounting: An Economic Framework to Identify Priorities*, Discussion Paper 98-49, James Boyd, Resources for the Future, September 1998.

[10] Kodak officials also noted that life cycle assessment is an emerging science, and further developments are needed before it can be used effectively and broadly during product design.

businesses to understand the full spectrum of their environmental costs and integrate those costs into the decision-making and capital-budgeting processes. EPA has also encouraged the use of pollution prevention by providing grants to states. Under the Pollution Prevention Incentives for States (PPIS) grant program, for example, funds are used to assist businesses and industries in identifying better environmental strategies and solutions for complying with regulations. Specifically, grants are provided for state and tribal pollution prevention projects, such as technical assistance, training, education, outreach, and awards and recognition programs.

Many states also have programs that focus on promoting the adoption of pollution prevention. Some states target their efforts toward environmental assistance programs. For example, the Minnesota Technical Assistance Program is a state-supported, non-regulatory program under which technical staff help businesses and industries identify opportunities where pollution prevention can help solve environmental problems. Other states have regulatory integration programs under which a facility's compliance record is considered holistically rather than just on a statute-by-statute basis. Under these programs, pollution prevention opportunities are often encouraged during the permitting, inspection, and enforcement processes. Other states maintain clearinghouses to gather and disseminate information on pollution prevention to interested organizations and the public at large.

## Factors That Discourage Wider Use of Pollution Prevention

Among the primary barriers hindering the wider use of pollution prevention are the technical challenges associated with new and sometimes unproven techniques. While some pollution prevention techniques involve relatively simple, common sense practices, others can involve significant changes, such as revamped production practices or changes in raw materials. These technical challenges are sometimes compounded by the preference among key decision-makers to rely on "tried and tested" methods. Second, pollution prevention methods may be rejected because they are not considered to be sufficiently profitable. The decision to adopt a pollution prevention measure may require more justification than a calculation showing that its benefits exceed its costs. Rather, proponents of the pollution prevention measure may need to demonstrate that its financial return will be greater than the return from alternative investments competing for the firm's capital. Third, regulations that prescribe the use of specific techniques to meet pollutant limitations have sometimes had the unintended effect of discouraging pollution prevention. Recognizing the possibility of these unintended consequences,

the Pollution Prevention Act requires that EPA review its regulatory proposals to determine their effect on source reduction. However, EPA has not systematically tracked its own compliance with this provision, and therefore does not know the extent to which source reduction has, in fact, been considered in the promulgation of EPA regulations.

## Technical Challenges Associated With New and Sometimes Unproven Techniques

Some pollution prevention techniques involve little more than the exercise of common sense over such matters as how materials are labeled, stored, or handled by facility personnel. Such measures require little investment in time and money, and pose little chance that the steps taken will be unsuccessful or result in unanticipated risk. In many cases, however, pollution prevention measures can involve significant changes to established practices, such as revamped production processes or changes in raw materials used. Such measures can be significantly more difficult to pursue. In addition, technical issues can pose substantial risks if changes are costlier than anticipated, affect the company's compliance with environmental or other requirements, or affect the quality of its product.

Both our site visits and recent studies indicate that even after extensive analysis and planning, some pollution prevention measures may pose technical uncertainties and considerable risk. Officials from Kodak Corporation, for example, cited their effort in the 1980s and 1990s to reduce emissions of methylene chloride, a key ingredient used in manufacturing the plastic sheeting that serves as the base of Kodak's photographic film. Officials saw two possible paths to take to achieve reduced emissions: (1) significant engineering changes to the manufacturing facility, which would reduce emissions through pollution prevention, or (2) the purchase of an "add-on" pollution control device. There was considerable internal resistance within the project team, because it was uncertain whether the proposed pollution prevention pathway could achieve the necessary emissions reductions, especially considering the need to meet regulatory deadlines for achieving the reductions. Concerns were also raised about the potential adverse effects that the changes with the pollution prevention effort could have on product quality. The pollution prevention measures were ultimately taken, resulting in the attainment of emissions reduction goals within the required regulatory timeframe. The measures also prevented emissions that would have resulted from operating a large air pollution control device; avoided the high cost of operating that device; and did not result in negative impacts on production equipment or product quality.

Similar concerns surfaced at the Dow Chemical Company's La Porte, Texas, facility as officials there launched efforts to determine whether emissions of monochlorobenzene could be eliminated through in-process recycling.[11] This pollution prevention opportunity presented an attractive alternative to the company because the successful recycling of the pollutant could facilitate the closure of a waste incinerator—which would otherwise require a major upgrade costing millions of dollars in order to meet regulatory standards. To shut down the incinerator, however, the facility found itself faced with a series of cascading issues. For example, it had to find ways of addressing other waste streams that were also burned in the incinerator, such as phosgene and methanol. These wastes would either have to be eliminated, recycled, or treated in another way if the incinerator were shut down, leading to a number of complications. The methanol, for instance, could be addressed in a number of ways, but each of the two options evaluated raised additional problems. For example, it could be sold to another firm for recycling, but the methanol itself was contaminated with impurities that would have to be removed before sale. Similarly, it could be burned off site, but this would incur transportation costs and the costs of off-site burning, which are typically higher than on-site burning. Shutting down the incinerator would also create "downstream" technical challenges. A wastewater treatment plant located at the facility used the incinerator's water to keep its own effluent within an acceptable range of salinity. Without the water from the incinerator, the biological treatment that removes organic compounds from the wastewater would be disrupted. These technical issues were critical factors leading to the project's deferral.

## Technical Uncertainties Are Particularly Challenging for Small Firms

Smaller firms face even more significant technical challenges in pursuing pollution prevention than their larger counterparts. According to the industry and regulatory officials we interviewed, smaller firms often do not have the technical ability or resources to pursue many pollution prevention alternatives. One expert explained that pollution prevention measures tend not to be "plug-in" technologies, but instead can require a great deal of technical sophistication and resources. Small firms generally do not have the technical ability and resources to identify such practices. The Environmental Law Institute also made this point in a 1999 study that showed that in the dry cleaning industry, "the small size and lack of

[11]A fuller discussion of this experience is contained in *Searching for the Profit in Pollution Prevention: Case Studies in the Corporate Evaluation of Environmental Opportunities,* by James Boyd, Resources for the Future, May 1998.

research or financial capacity in virtually all firms in the industry precluded research or development of several promising alternatives to the use of perchloroethlyene, the principal solvent used in dry cleaning."[12] The study concluded that industries dominated by small business lack both the technical and financial capacity to conduct the necessary research efforts to identify new opportunities.

Pollution prevention officials from Delaware, Illinois and New York also emphasized that a lack of knowledge and technical sophistication inhibits the wider use of pollution prevention by small and medium-sized firms. An official at the New York Department of Environmental Conservation told us that smaller firms face many barriers, including a lack of resources for the initial outlay, a lack of expertise, an unwillingness to change time-honored practices, and time constraints. An official of the Illinois Environmental Protection Agency raised similar issues, noting in particular that the main barrier affecting small- and medium-sized firms was a lack of information and technical sophistication. He said such firms typically do not have the time and resources to research and evaluate their options, and therefore need mentors, such as experts from larger firms, to help them identify and implement various options. Accordingly, many states have established technical assistance programs specifically designed to assist smaller firms identify and implement pollution prevention measures.

## Technical Challenges Are Sometimes Compounded by Institutional Resistance

These difficult technical challenges are sometimes compounded by the common phenomenon in many organizations to rely on "tried and tested" methods and to avoid significant risks that could expose a company to financial loss, liability, or other problems. This point was raised during many of our interviews with state and industry officials. For example, a representative of the Delaware Department of Natural Resources and Environmental Control said that long established practices and habits can be hard for a firm to break, especially when there are concerns about the market and customer preferences. The official recalled a visit to a maker of filing cabinets that had painted the inside of their high-end cabinets, even though the metal was pre-coated. The official pointed out that the company could save material and reduce waste by ending this practice, but the company was reluctant to do so because it feared customer

[12]Environmental Law Institute, *Innovation, Cost, and Environmental Regulation: Perspectives on Business, Policy, and Legal Factors Affecting the Cost of Compliance*, May 1999.

reaction. After a few years, the company stopped painting the inside, and the feared loss in sales did not materialize.

Similarly, the organization and allocation of responsibility for environmental matters within a firm can impede identification and implementation of pollution prevention measures. More complex pollution prevention approaches require intimate familiarity with the production process, such as that possessed by line workers, managers, and engineers. However, as a 1994 report by the Office of Technology Assessment noted, "Responsibility for finding pollution prevention solutions may not rest with those most capable of doing so."[13] Indeed, they may oppose pollution prevention measures over concerns that the measures will divert resources away from production, or over concerns that pollution prevention initiatives may harm product quality. Environmental management is often the responsibility of a separate department in a firm, which may not have effective communication or working relationships with other more knowledgeable staff.

## Pollution Prevention Measures May Not Be Sufficiently Profitable

As noted above, the prospect of financial gain has perhaps been the primary impetus behind many successful pollution prevention efforts. In other cases, however, concerns over financial risk or a poor rate of return—particularly when compared to other candidates for capital investment—often act as a deterrent to undertaking pollution prevention.

Particularly for smaller firms, the up-front capital investment required for some pollution prevention measures may be enough of a deterrent to discourage a company from changing long-established practices to pursue pollution prevention opportunities. A pollution prevention official from New York's Department of Environmental Conservation reinforced this point, noting that smaller firms in particular are generally unwilling or unable to make the initial outlay for process changes or additional equipment. The point was also made in the 1994 Office of Technology Assessment report, which noted that some industries with low profits and mature markets and equipment, such as metal finishing, invest less in new

[13]U.S. Congress, Office of Technology Assessment, *Industry, Technology, and the Environment: Competitive Challenges and Business Opportunities,* January 1994.

facilities. [14] As a consequence, making investments in pollution prevention equipment can be more difficult, regardless of the expected payback.

Ironically, in the case of large corporations, a comparatively small investment required by some pollution prevention efforts can become a barrier, if the small size of the proposed project provides it with insufficient visibility for corporate management. Such was the case in the Michigan Source Reduction Initiative involving Dow Chemical Company, the Natural Resources Defense Council, and other participants. Under the initiative, participants sought to reduce releases of 26 priority chemicals by 35 percent using only pollution prevention techniques. To do so, the company's Midland, Michigan facility identified and implemented 17 projects with capital costs ranging between zero and $330,000. According to the report documenting the results of this initiative, a key lesson learned from the project was that low-cost projects are often overlooked by the engineering staffs of large companies even when they have the potential to realize large reductions.[15] A Dow official told us that the company only pursued so many relatively small-scale measures because they were treated as a group of projects under the company's Source Reduction Initiative. He suggested that had the measures been outside the context of the Initiative, they probably would not have caught the attention of upper management or the interest of engineering staff.

An additional key message stemming from the Dow experience is that it is not necessarily sufficient that a project have a net positive return for it to be viewed as a worthwhile investment. As a Dow official told us, a proposed pollution prevention project has to have a projected return on investment greater than or equal to the return expected of any company investment—the "hurdle rate." The environmental official participating in this process noted that the concept of a hurdle rate was surprising, as she had previously assumed that it would be sufficient incentive if a pollution prevention project "paid for itself."

The notion that pollution prevention proposals must often compete with other projects—and therefore do more than simply pay for themselves—was also cited by other industry and state pollution prevention officials we

[14]Ibid.

[15]Dow Chemical Company, Natural Resources Defense Council, et. al., *Preventing Industrial Pollution at Its Source: The Final Report of The Michigan Source Reduction Initiative*, September 1999.

interviewed. DuPont officials, for example, told us that the corporate environmental plan has a database of several thousand potential waste reduction projects. Generally, 80 percent of the mass emissions are from 20 percent of the sources. The firm ranks the proposals by cost and waste reduction potential. Its objective is to achieve 80 percent of the benefit from the entire list of proposals for 20 percent of their total projected cost. Projects falling below this cutoff are generally not implemented. Similarly, the representative of the Minneapolis printing firm told us that his company had considered purchasing equipment that would have expanded its ability to extract solvent from soiled shop towels on-site, as opposed to shipping the soiled towels off-site for laundering. The representative explained that after comparing this pollution prevention proposal to other investments, the firm ultimately chose not to go ahead with the $135,000 proposal.

## Prescriptive Regulations Often Discourage Pollution Prevention Techniques

Broad agreement exists among environmental experts and practitioners that in some respects, regulatory standards have been an important catalyst in promoting pollution prevention by compelling industry to lower their overall pollutant releases. However, certain types of regulations can have the unintended effect of discouraging pollution prevention. In particular, regulations that prescribe the use of specific technologies to meet pollutant limitations can discourage (or preclude) regulated entities from choosing the best tools to achieve these limitations—tools that may often include pollution prevention.

The prescriptive nature of some environmental regulations has been the subject of an extensive literature. In summarizing this literature, the Environmental Law Institute (ELI) notes that a central problem has been that the design of most standards under the Clean Water Act and Clean Air Act require EPA to establish technology-based discharge rate limits based on "available" or "feasible" emission control technologies.[16] For air, such standards include "reasonably available control technology" for existing sources, "best available control technology" for new sources, and "maximum achievable control technology" for hazardous pollutants. Water standards include "best available technology economically achievable."

[16]Environmental Law Institute, *Innovation, Cost and Environmental Regulation: Perspectives on Business, Policy, and Legal Factors Affecting the Cost of Compliance*, May 1999. The Environmental Law Institute is an independent research and education center that seeks to develop effective solutions to pressing environmental problems.

Although such standards do not necessarily preclude companies' use of pollution prevention, ELI notes that such standards can discourage pollution prevention in a number of ways. For example, they can emphasize, or even dictate, end-of-pipe compliance solutions instead of process or other pollution prevention solutions. Even in cases where other preventive solutions are not explicitly prohibited, the lack of time, resources, and willingness to accept risk may lead state permit writers to disapprove methods of reducing emissions other than through established control technologies. ELI also notes that fixed rate standards do not provide incentives for further progress. Consequently, firms that have installed end-of-pipe control technologies may have little reason to pursue pollution prevention efforts and instead focus mainly on staying in compliance. ELI summarizes the effect of prescriptive standards by noting that they "may severely limit innovation, creating higher costs than necessary."

While acknowledging that such regulations are framed to some extent by their governing statutes, ELI also asserts that many of the problems in the current system could be avoided by better designed regulations—ones that set overall performance standards while allowing for greater flexibility on how to achieve those standards. ELI cites the history of regulation of sulfur dioxide emissions by electric power plants as perhaps the best example of the problems with technology prescriptions. ELI notes that cost estimates for mandated scrubbers "which allows no room for innovation except in scrubber technology" were about $7 billion per year. By contrast, the use of a performance standard (adopted in 1990)—which included an emissions cap for facilities which could be achieved flexibly through emissions trading, switching to less-polluting fuels, and other innovative techniques—was estimated to cost about $2.5 billion.

Another example raised by state regulatory officials we contacted focused on a key aspect of EPA's Maximum Achievable Control Technology (MACT) policy. Referred to as EPA's "once-in, always-in" policy, this requirement permanently subjects firms to detailed administrative requirements. According to an EPA guidance issued in May 1995, facilities classified as major sources of hazardous air pollutants on the first compliance date after a new MACT standard is promulgated are permanently required to comply with the requirements for major sources, even if their emissions are subsequently reduced below the "major source" threshold. EPA explains that a facility's reduced emissions would not be federally enforceable, and that emissions may not always stay below the MACT threshold once they go below it. According to the State and Territorial Air Pollution Program Administrators and the Association of

Local Air Pollution Control Officials (STAPPA/ALAPCO), however, the policy discourages pollution prevention methods, such as new manufacturing techniques, which could lower emissions well below specific MACT standards. Moreover, there is no incentive for a facility to consider further reductions or to investigate new, less-polluting technologies, since they remain subject to the MACT standards regardless of their emissions. In a 1998 letter to EPA, the STAPPA/ALAPCO Pollution Prevention and Sustainability Committee cited an example of a furniture manufacturing facility that switched from solvent-based to ultraviolet light-cured coatings, and thereby reduced its emissions of hazardous air pollutants from 50 tons to 200 pounds annually, below the MACT threshold. Had the switch been made before the MACT compliance date, the facility would still have been subject to the MACT requirements. The Committee further stated that the ultraviolet light curing technology should increasingly be available to other sources. However, due to the "once-in, always-in" policy, there was no incentive for a source to commit capital to changing its processes since it would still be subject to the MACT threshold. While EPA has not yet resolved this issue, the agency is currently considering several rulemaking approaches to address the problems identified by state regulators, including regulatory language that can be included in existing and future MACT rules.

Beyond the impacts of any particular regulation on pollution prevention, an Intel representative also suggested that the cumulative effect of numerous regulations might have an additional dampening effect on companies' use of these practices. He stated that the sheer volume and complexity of these regulations often overwhelm environmental staffs, whose primary job is to keep their firms in compliance. Their efforts to comply with regulations often divert them from focusing on preventive approaches that could help them achieve more optimal environmental results. Several other state and industry officials we contacted echoed these sentiments. For example, a representative of a printing industry trade association said that many firms see pollution prevention as a way of going "beyond compliance," but that they may have little incentive to do so. He explained that if they must devote time and money to meet detailed permit requirements, they see no compelling reason to go further.

Thus, while the goal of pollution prevention has broad support within and outside EPA, and is explicitly supported by the Pollution Prevention Act, agency regulations have sometimes had the unintended effect of discouraging these practices. In recognition of the problem, the act required the EPA Administrator, as part of a strategy to promote source reduction, to "review regulations of the Agency prior and subsequent to

their proposal to determine their effect on source reduction." Importantly, the provision does not preclude the adoption of regulations, such as those discussed above, but rather requires that pollution prevention be *considered* in their development, and that they be reviewed to determine their effect on pollution prevention.

Yet according to EPA officials, the agency has not systematically tracked its implementation of this provision and therefore cannot identify the extent to which source reduction has been considered in the promulgation of EPA regulations. A 1996 EPA study, however, suggested that consideration of source reduction in the development of regulations has been, at best, inconsistent.[17] The report, which examined the agency's efforts to incorporate pollution prevention in a sample of its regulations, concluded that "pollution prevention approaches are still not used consistently in EPA rule development and implementation," and that in the case of many rulemakings, goals are set "in a way that discourages people from seeing [pollution prevention] as their principle of first choice in the environmental management hierarchy."

The report noted that requirements of other statutes have the potential to preclude or discourage wider consideration of pollution prevention in rulemakings.[18] However, it also cited instances where the belief among staff that statutes prohibit pollution prevention approaches may in fact be unwarranted. It noted, for example, that "the lack of explicit direction in statutory language in [the Resources Conservation and Recovery Act and the Clean Water Act] on prevention fosters a perception that these statutes do not make prevention a priority, but it is not clear whether they pose actual barriers." Indeed, the report cited a number of obstacles other than the statutes that "detract from a consistently strong multi-media and [pollution prevention] perspective in rulemaking." Among the obstacles discussed were the lack of incentives for multi-media coordination in planning and budgeting, difficulties in promoting pollution prevention process changes and innovative technologies within the agency, a lack of understanding about cross-media impacts, and the lack of clarity as to

[17]Environmental Protection Agency, *Preventing Pollution Through Regulations: The Source Reduction Review Project*, February 1996.

[18]For example, the report cites the Clean Air Act's requirement to address 189 Hazardous Air Pollutants, noting that "the inflexibility of this requirement can often mean requiring expensive control devices even when prevention options exist."

how leadership for pursuing pollution prevention should be shared among all major EPA offices.

Given the prospect that pollution prevention may be used as an option more frequently than currently recognized by agency rulemakings, we believe it is all the more important for the agency to ascertain its compliance with the Pollution Prevention Act's requirement that it determine the effect of its regulations on source reduction efforts.

## Conclusions

Many of the factors that influence a company's decisions concerning pollution prevention practices are beyond the purview of government policy. Whether to undertake pollution prevention is typically a business decision that is influenced largely by a company's judgment as to whether an investment in pollution prevention will benefit it financially.

One notable exception, however, is in the design of environmental regulations, some of which have had the unintended consequence of discouraging pollution prevention practices. In some cases, EPA may have no means to address them. The design of some regulations, for example, may be constrained by their governing statutes. In other cases, however, EPA may be better able to take the national goal of promoting pollution prevention into consideration in developing its regulatory proposals.

To encourage greater consideration of pollution prevention in development of EPA regulations, the Pollution Prevention Act requires EPA to review its regulatory proposals to determine their effects on source reduction. However, the agency has not systematically tracked the implementation of this provision, and therefore does not know the extent to which source reduction has, in fact, been considered in the promulgation of EPA regulations. Anecdotal evidence suggests that, at best, such consideration is provided on an inconsistent basis.

While it may be impossible to promote pollution prevention in all of the agency's regulations, a greater awareness of these practices in the agency's rulemaking process can help significantly to further this important national goal. Accordingly, we believe it would be useful for EPA to undertake a systematic analysis to determine its compliance with this provision, and if necessary, develop a plan to improve its compliance.

## Recommendation

We recommend that the Administrator, EPA, systematically determine the extent to which the agency is complying with the Pollution Prevention

Act's requirement that EPA "review regulations of the Agency prior and subsequent to their proposal to determine their effect on source reduction." If warranted by the results of the agency's analysis, we further recommend that the Administrator develop a plan to improve the agency's compliance.

## Agency Comments

EPA commented that our report could mention a variety of agency programs and other activities initiated to promote pollution prevention. While our draft report had touched on several of these activities, we added a fuller discussion of them to this chapter. We also recognized the role of many state programs in encouraging pollution prevention.

The officials also noted that in characterizing the impacts of its regulations on pollution prevention, it is also important to consider the impacts on pollution prevention of permitting, inspections, enforcement, and other activities associated with the *implementation* of regulations. They further noted that the Pollution Prevention Act encourages consideration of pollution prevention in permitting, inspection, and enforcement; and that consequently, any recommendation concerning the consideration of pollution prevention in the development of regulations should also address the way pollution prevention is taken into account in these implementation-related activities as well.

The draft report had acknowledged that these implementation activities can significantly affect pollution prevention efforts. It cited the enforcement process as an example, noting that innovative pollution prevention measures are often included in enforcement settlement agreements. Our recommendation, however, focused on EPA's development of regulations (as opposed to their implementation) because it was that part of the process that was most frequently cited as a disincentive within the regulated community to engage in pollution prevention. That said, we acknowledge the value of any EPA effort to encourage greater consideration of pollution prevention in permitting, inspection, and other aspects of regulatory implementation.

# Appendix I: GAO Contacts and Staff Acknowledgments

## GAO Contact

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## Acknowledgments

In addition to the individual named above, Mike Hartnett and Stephanie Luehr made key contributions to this report. Important contributions were also made by Chuck Bausell,Tim Guinane, David Henry, Karen Keegan, and Jonathan McMurray.

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