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by **Barbara B. Wells**

**Natural Resources Policy Studies
Center for Policy Research**

National Governors' Association

Since their initial meeting in 1908 to discuss interstate water problems, the Governors have worked through the National Governors' Association to deal collectively with issues of public policy and governance. The association's ongoing mission is to support the work of the Governors by providing a bipartisan forum to help shape and implement national policy and to solve state problems.

The members of the National Governors' Association are the Governors of the fifty states, the territories of American Samoa, Guam, and the Virgin Islands, and the commonwealths of the Northern Mariana Islands and Puerto Rico. The association has a nine-member Executive Committee, a Task Force on State Management, and three standing committees—on Economic Development and Commerce, Human Resources, and Natural Resources. Through NGA's committees, the Governors examine and develop policy and address key state and national issues. Special task forces often are created to focus gubernatorial attention on federal legislation or on state-level issues.

The association works closely with the administration and Congress on state-federal policy issues through its offices in the Hall of the States in Washington, D.C. The association serves as a vehicle for sharing knowledge of innovative programs among the states and provides technical assistance and consultant services to Governors on a wide range of management and policy issues.

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Preface

Environmental protection for decades concentrated on controlling harmful emissions incrementally—one medium at a time, one pipe at a time—through narrowly focused laws and programs. Yet despite government's best efforts, the limitations of this approach are apparent. Single-medium controls do not always reduce total pollution; regulatory micro-management can discourage innovation; and sources of pollution exist beyond regulated industries—governments, small businesses, and households also pollute. Comprehensive and cost-effective environmental protection calls for preventing pollution at its source.

Today, nearly every state has made a commitment to promoting pollution prevention—using resources efficiently to reduce or eliminate waste. Most state efforts began within environment agencies, but increasingly pollution prevention programs are being established throughout state government. This report examines state initiatives that show the promise of prevention.

The project was undertaken through a cooperative agreement with the Pollution Prevention Division of the U.S. Environmental Protection Agency's Office of Pollution Prevention and Toxics. The report was produced with the assistance of a state advisory committee, including: Russell Barnett, Deputy Commissioner of the Department of Environmental Protection (Kentucky); Kathryn Barwick, Alternative Technology Division (California); Philip Cherry, Director of the Waste Minimization Program (Delaware); Mike Dawson, Executive Assistant to the Governor (Ohio); Nick DiPasquale, Director of the Waste Management Program (Missouri); Dan

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Executive Summary

Pollution prevention is a simple concept: Achieve the most efficient use of resources to reduce or eliminate waste. Yet, despite the universal appeal of this idea, the current web of complicated environmental regulations and policies has created a preference for treatment and disposal over prevention. This report examines some efforts of states to loosen this web through programs that aim to stop pollution at its source. These programs require a commitment by state leaders at the highest levels to find a better way to protect the environment and overcome entrenched practices twenty years in the making.

What Is Pollution Prevention?

The U.S. Environmental Protection Agency, Congress, and numerous states have painstakingly defined pollution prevention. The principles most often cited include:

- Reduce or eliminate the generation of pollutants or waste.
- Minimize or eliminate the use of toxic materials in manufacturing.
- Substitute less harmful materials for toxic ones in the production process.
- Attempt to ensure that reducing emissions to one environmental medium does not increase emissions to another.
- Maximize the efficient use of resources.

For purposes of this report, pollution prevention is limited to the reduction of pollutants entering the waste stream or the environment prior to recycling, treatment, or disposal.

How Are States Promoting Pollution Prevention?

The pollution control mentality is partially rooted in the single-medium focus of environmental statutes. Separate laws for air, water, and waste discharges have produced distinct regulations, implementation schedules, and bureaucratic structures. The effect of this single-medium, single-pipe approach can be a failure to achieve net pollution reductions even in the face of ambitious standards and costly controls. At worst, a focus on reducing emissions to one medium may ignore the inadvertent creation of pollution increases elsewhere in a facility.

A multi-media approach and pollution prevention are not interdependent; they reinforce one another. States are starting to look at the whole facility when assessing pollution to reveal prevention opportunities. These efforts can lead to greater coordination of various single-medium programs and improved program efficiency.

Over the last decade, state environment agencies have sought better ways of protecting the environment, and many have focused their efforts on industrial waste reduction. However, the environment agency need not be the sole advocate and impetus for pollution prevention, and industry need not be the only target of these efforts. Countless programs in the entire range of state agencies already are reducing waste. For example:

- **Transportation departments** in many states are lowering motor vehicle emissions through transportation systems management. This involves innovations such as traffic engineering improvements that lower fuel consumption and ridesharing programs that reduce the number of commuter cars on the road.

- **Energy offices** are curbing air emissions by lessening the demand for electricity generated by burning fossil fuels, instituting energy efficiency codes for buildings and appliances, and creating incentives for using demand-side management.

- **Agriculture departments** are helping prevent water pollution from agricultural runoff by encouraging use of alternatives to chemical fertilizers and pesticides. Other practices, such as the no-tillage planting method, reduce agricultural energy consumption.

- **Commerce departments and economic development agencies** are creating incentives, such as tax breaks, loans, and even on-site technical assistance, for businesses to undertake pollution prevention projects.

- **State enforcement agencies** are incorporating waste reduction requirements into consent decrees for environmental violations.

Interstate cooperation can enhance all of these efforts by pooling resources for common activities and addressing regional environmental problems. Member states share information and expertise and devise strategies—sometimes in the form of model legislation—to protect their shared air and water.

The Massachusetts Blackstone Project uses multi-media compliance inspections to review total discharges. It has proven that one multi-media trained facility inspector can do the work of four traditional inspectors and at the same time identify pollution prevention opportunities.

Chapter 2

Prompted by the Maine Public Utility Commission's demand-side management program, Central Maine Power distributed \$9 coupons for super energy-efficient light bulbs to 450,000 customers. The 165,000 bulbs sold in 1991 will eliminate emissions of 123,750 tons of carbon dioxide and 1,650 tons of sulfur dioxide over their life.

Chapter 3

When a large company violated state environmental laws, the California Department of Toxic Substances reached a consent agreement in just five days by offering to divert \$3.95 million of the \$8.95 million fine back to the company to finance a waste reduction audit and pollution prevention plan.

Chapter 3

The North Carolina Pollution Prevention Program offers technical assistance for multi-media waste reduction. A five-person staff conducts site visits, develops facility and waste-stream specific reduction reports, and performs a host of outreach activities.

Chapter 5

In September 1991, Minnesota Governor Arne H. Carlson issued an executive order directing state agencies to begin pollution prevention. The order created an Interagency Pollution Prevention Advisory Team to promote cooperation throughout the government and guide agencies in integrating pollution prevention practices into their activities.

Chapter 7

The Louisiana Department of Environmental Quality used the 1988 Toxics Release Inventory to identify the top twelve emitters of toxics to air, land, and water in the state. The department then publicly asked the companies to adopt voluntary pollution prevention plans. Most did, contributing to a 38 percent drop in the state's toxic releases the following year.

Chapter 5

Because of the high cost of polluting, business and industry already have a strong incentive for implementing pollution prevention methods. Many states build on these incentives by utilizing:

- **Outreach and technical assistance programs** that prompt pollution prevention activities through seminars, printed information, resource clearinghouses, and waste audits and process design consultation performed on site.
- **Economic incentives** that increase the financial benefits of pollution prevention, such as fees on waste generation and tax breaks, grants, and low-interest loans for pollution prevention expenditures.
- **Regulatory requirements** that spur pollution prevention by requiring manufacturers to eliminate certain toxic substances or by prompting industrial facilities to identify pollution prevention opportunities themselves through mandatory planning.
- **Disclosure requirements** that alert companies to high volumes of waste generation they may not have recognized; enable states to spotlight some of the worst polluters and create public pressure for them to reduce waste; and give public recognition to the most efficient companies.

These incentives help states and businesses overcome pollution prevention barriers such as reluctance to commit scarce resources; preoccupation with prescribed end-of-pipe waste controls; and adherence to institutionalized waste management practices and attitudes.

How Can States Make Pollution Prevention Work?

Policymakers, academicians, government regulators, and business managers invariably describe pollution prevention as a “win-win” proposition. It cuts costs, preserves natural resources, and reduces the regulatory burden for both government and industry. Because it presents a rare opportunity for public-private cooperation, the most effective role for government in encouraging pollution prevention is to underscore its rewards, identify methods for achieving it, and invest the necessary time and resources. The following steps can be instrumental in helping government fulfill this role.

- **Promote pollution prevention at the highest levels of state government.** Leadership from the Governor, the legislature, and agency heads is essential for initiating pollution prevention activities throughout state government, for promoting their use in the private sector, and for sharing resources to achieve pollution prevention goals.
- **Create a multi-media focus.** Agencies and industry must be encouraged to examine the “big picture” to reduce pollution. This does not require dismantling existing single-medium programs, but rather improving their integration so they can be used to achieve overall emissions reductions across all media.
- **Accommodate and reward private sector pollution prevention initiatives.** State government must be willing to change the way it does business to facilitate pollution prevention, whether through regulatory flexibility, improved

and expedited permitting, or negotiation of consent decrees that incorporate pollution prevention. Tax breaks, grants, and loans for pollution prevention also spur industry to act, enabling companies to make capital and personnel investments that pay for themselves in savings over time.

- **Forge public-private cooperation.**

The private sector should be included in the development of state programs, not only to determine business needs and motivations, but also to engender its trust and commitment.

- **Provide technical assistance.** On-site technical assistance, clearinghouses, seminars, and other outreach activities help businesses identify pollution prevention methods that are most appropriate for their operations.

- **Collect reliable quantitative and qualitative pollution prevention data.**

Improved data not only will provide a baseline for gauging pollution prevention success, but also will expose the most excessive or threatening emissions that require the most attention.

- **Participate in interstate organizations.** Regional state organizations can promote the exchange of pollution prevention information, experiences, and legislation, and can provide a vehicle for regional cooperation.

Delaware Governor Michael N. Castle's Green Industries Initiative provides special tax incentives, financial aid, and technical assistance to companies that have demonstrated success in pollution prevention.

Chapter 3

By consolidating twenty-eight environmental databases into a single master file, the Massachusetts Bureau of Waste Prevention will obtain a whole facility view of 20,000 regulated facilities in the state.

Chapter 7

Through the Chesapeake Bay Program, Maryland, Pennsylvania, and Virginia have implemented agricultural nutrient management programs that so far have kept 1,797 tons of nitrogen and 2,006 tons of phosphorous from reaching the bay.

Chapter 4

Introduction

What is pollution prevention? Is it toxics reduction or waste minimization; product substitution or process modification? Is it introducing new technology or redirecting old technology; creating new practices or revamping old ones? Is it institutional overhaul or simple adjustment; complex concepts or common sense?

The answer: yes. Pollution prevention encompasses a vast range of ideas bound together by a single objective: to achieve the most efficient use of resources to reduce or eliminate waste. For purposes of this report, pollution prevention is defined as Congress, the U.S. Environmental Protection Agency, and several states have described it (see *Defining Pollution Prevention* on page 11). It includes practices that reduce pollutants entering the waste stream or the environment prior to recycling, treatment, or disposal.

States view pollution prevention as an opportunity to achieve greater environmental protection without increasing costs. Yet while this concept is endorsed by both government and industry, they are ensnared in a web of complicated environmental regulations and industrial operations that creates a preference for treatment and disposal over prevention.

This report examines some of the state programs that have broken through this web, fostering the will and ability to stop pollution at its source. The report presents examples of these programs, found in a variety of state agencies that influence a host of public and private activities. It also describes the barriers to pollution prevention efforts and recommends ways to overcome them.

The report was prepared under the guidance of an advisory group of state officials (see Appendix A). Based on their collective experience in implementing pollution prevention programs in different regions of the country, these officials suggested that the report focus on the following topics:

- The ways in which state agencies other than environment departments have established pollution prevention programs (discussed with examples in Chapter 2).
- The role of multi-media environmental analysis and management in facilitating pollution prevention (examined in Chapter 3).
- The regional and multi-state cooperation that has enhanced and sometimes spurred pollution prevention efforts in individual states (explored in Chapter 4).
- The use of incentives by environment and other agencies to encourage or enable industry to undertake pollution prevention measures (discussed with examples presented in Chapter 5).
- Barriers to pollution prevention that must be addressed before states can make significant progress (described in Chapter 6).
- State advisory group findings and recommendations on ways to make better use of pollution prevention opportunities (described in Chapter 7).

The report is based on three assumptions—that prevention is almost always cheaper than the cure (treatment, disposal, and environmental remediation); that the role of government should be to provide pollution prevention tools (education, financial assistance, and incentives); and that state pollution prevention efforts may require new approaches rather than more staff and money.

Defining Pollution Prevention

The U.S. EPA and a number of states have painstakingly defined pollution prevention. Several of these definitions appear in Appendix B. While the definitions vary, all contain several universal concepts. They include:

- Pollution prevention reduces or eliminates the generation of pollutants or waste.
- Pollution prevention minimizes or eliminates the use of toxic materials in the manufacturing process.
- Pollution prevention substitutes less harmful materials for toxic ones in the production process.
- Pollution prevention attempts to ensure that reducing emissions to one environmental medium does not increase emissions to another.
- Pollution prevention seeks to maximize the efficient use of resources.

Instituting Pollution Prevention Throughout State Government

Every human activity produces pollution. If government limits responsibility for preventing pollution to environment agencies and the activities they regulate, countless opportunities to protect natural resources and reduce waste may be overlooked. While most pollution prevention efforts will continue to occur in the industrial sector through environmental agency programs, pollution prevention must be an objective throughout the entire government. This requires a comprehensive assessment of all activities to maximize efficiency.

State transportation, energy, agriculture, and economic development departments all produce pollution and influence aspects of the private sector that generate waste. These agencies possess a wide variety of tools to promote pollution prevention, whether it means changing their own wasteful practices or prodding business and industry to change theirs. For example:

- Transportation departments can cut vehicular emissions by promoting ride-sharing and improving transportation systems management.
- Energy departments and public utility commissions can reduce emissions from power plants through energy conservation efforts.
- Agriculture departments can lower nonpoint source pollution by implementing sustainable agriculture practices.

Other state agencies can create incentives for businesses to prevent pollution. Commerce departments can provide financial assistance for private sector

pollution prevention efforts and reward businesses that successfully implement them with tax breaks and other benefits. Offices of the attorneys general in each state can incorporate pollution prevention agreements into consent decrees for facilities that have violated environmental laws.

These ideas are not hypothetical; many states already have put them into practice and are devising additional pollution prevention strategies. This chapter illustrates how various state agencies have incorporated pollution prevention into their individual missions and programs.

Pollution Prevention Laws

In recent years, many states have enacted pollution prevention laws, which usually are implemented by environment agencies and are aimed primarily at industrial facilities. While this report focuses on the potential to extend pollution prevention efforts beyond environment agencies, the importance of these industrial source reduction programs cannot be overstated. The following are just a few examples of ground-breaking pollution prevention legislation.

Massachusetts

Massachusetts paved the way for many states when its landmark Toxics Use Reduction Act (TURA) was signed into law in 1989. The bill represented a cooperative effort of the Associated Industries of Massachusetts and the Massachusetts Public Interest Research Group, and passed both houses of the legislature unanimously. TURA encompasses many of the policies that have guided other

state pollution prevention efforts. The act:

- Created a statewide goal of reducing toxic waste generation by 50 percent by 1997 through toxics use reduction, which was defined as in-plant changes in production processes or raw materials that reduce, avoid, or eliminate the use of toxic or hazardous substances or generation of hazardous by-products per unit of product.
- Established an Office of Toxics Use Reduction Assistance and Technology to provide technical assistance to industrial toxics users.
- Created a Toxics Use Reduction Institute at the University of Lowell to develop training programs; engage in research, development, and demonstration of toxics use reduction methods; and conduct a study on the restriction of chemical use in the state.
- Required users of large quantities of toxics (initially those companies included in the federal Toxics Release Inventory) to conduct an inventory of chemicals flowing in and out of each production process at their facilities and to develop a toxics use reduction plan for each process.
- Created an Administrative Council on Toxics Use Reduction to include representatives of the state departments of Environmental Protection and Public Health and the offices of Environmental Affairs, Economic Affairs, Labor, and Science and Technology. With the assistance of an advisory board that includes representatives of industry and environmental groups, the council is

responsible for recommending allocations of the Toxics Use Reduction Fund.

- Authorized the administrative council, after July 1, 1995, to designate certain industry groups as "priority user segments." The Department of Environmental Protection can require companies in these groups to comply with TURA's reporting and planning requirements if they are not covered by TURA already, and also may impose performance standards.

Minnesota

In October 1989 the Minnesota Office of Waste Management organized a steering committee representing industry, environmental groups, and state government to develop a strategy for preventing environmental toxic releases by eliminating these pollutants at their source. Their work led to passage of the 1990 Minnesota Toxic Pollution Prevention Act, which:

- established a state policy encouraging pollution prevention, which reduces toxic pollution at its source and minimizes the transfer of toxic pollutants from one environmental medium to another;
- expanded the Minnesota Technical Assistance Program to help companies identify and implement pollution prevention measures such as process or product modification, inventory controls, feedstock substitutions, and improved machinery efficiency;
- allocated \$150,000 for matching grants to companies for research and demonstration projects to assess the feasibility

of specific pollution prevention technologies and methods; and

- requires all facilities included in the federal Toxics Release Inventory to develop toxic pollution prevention plans that establish goals for reducing or eliminating toxic pollutant releases. Annual progress reports based on the plans must be submitted to the Minnesota Pollution Control Agency, which makes them available for public review.

Texas

Based on recommendations of the Texas Waste Reduction Advisory Committee and with Governor Ann W. Richards' support, the Texas legislature passed S.B. 1099 in May 1991. This legislation:

- established a state policy of reducing pollution at its source and minimizing the waste that cannot be reduced;
- requires the Texas Air Control Board and the Texas Water Commission to develop statewide waste reduction plans;
- requires all facilities that report under the Toxics Release Inventory or generate hazardous waste to develop facility-wide waste reduction plans; to make an executive summary of the plan available to the public; and to report annually to the state on progress in implementing the plan;
- created a Pollution Prevention Council to coordinate designated agencies' source reduction and waste minimization activities; and
- established an Office of Pollution Prevention at the Texas Water Com-

mission to assist hazardous waste generators and owners of pollutant-releasing facilities in reducing the volume and toxicity of their waste or releases.

The Texas pollution prevention program currently distributes information on source reduction technologies; develops training programs for state and local regulators and industry; provides on-site facility assistance and audits; offers a case study book on successful industrial waste minimization projects and a manual on source reduction and waste minimization assessment; maintains an information clearinghouse, coordinated with the Gulf Coast Hazardous Substance Research Center at Lamar University; and is developing a reporting system for measuring source reduction and waste minimization progress.

Transportation Departments

State transportation departments directly influence one of the greatest sources of air pollution—motor vehicles. Despite the dramatically improved fuel efficiency and pollution controls of automobiles over the last two decades, vehicular emissions are climbing because of the growing number of cars on the road, the hours they spend idling in traffic, and the increasing “vehicle miles traveled.” Mobile sources contribute 54 to 70 percent of the carbon monoxide, 30 to 45 percent of the nitrogen oxides, 28 to 34 percent of the hydrocarbons, 18 percent of the particulates, and 73 percent of the lead emitted into the air.¹ Americans are detained in traffic for some 1 billion hours a year, wasting 2 billion gallons of gasoline.² To reduce these numbers, transportation departments can

take cars off the road through creative approaches that encourage ridesharing and the use of mass transit. They also can improve transportation planning to ease congestion.

The transportation sector's role in pollution prevention promises to grow with the implementation of the federal Intermodal Surface Transportation Efficiency Act of 1991. The law includes a Congestion Mitigation and Air Quality Improvement Program, which directs \$6 billion toward transportation projects in Clean Air Act nonattainment areas for ozone and carbon monoxide. The projects will help attain the national ambient air quality standards.

In addition to cutting vehicular emissions, transportation departments can reduce pollution, such as chemical runoff, from their own road construction and maintenance work. By recognizing the environmental impact of their activities, transportation agencies have devised ways of incorporating pollution prevention into some of their policies.

Transportation Systems Management Cuts Idle Time in Traffic

Emerging methods to manage traffic—termed transportation systems management (TSM)—can reduce traffic congestion and the pollution that accompanies it. TSM involves progressive timing of traffic signals, computerized traffic control, and other traffic engineering improvements that result in lower levels of fuel consumption and mobile source air emissions. In New York, TSM is an important component of the Department of Transportation's corporate mobility goal, which calls for

policies and programs that reduce congestion at a reasonable cost.³

The New York State Energy Office, in cooperation with the transportation department, supports TSM through the Signal Timing Optimization Program, which provides training and technical assistance to municipalities to reset traffic signals for more efficient traffic flow. The program has awarded funds to retime nearly 1,000 of the 20,000 signalized intersections in the state. The energy office estimates that approximately 1.2 million gallons of fuel are saved as a result of the 400 signals retimed each year. Such savings roughly translate to annual emission reductions of 120,000 pounds for hydrocarbons, 720,000 pounds for carbon monoxide, and 120,000 pounds for nitrogen oxides.⁴

Advanced Toll Collection and Congestion Pricing Increase Highway Efficiency

Toll collection directly charges users for road construction and maintenance and reduces congestion because it discourages road use for nonessential driving. However, a drawback of traditional toll roads is the auto emissions caused by cars slowing down before the toll gate and accelerating after. A demonstration project in California shows how this problem could be resolved.

The project is financing a two-lane expansion of State Route 91 through the collection of tolls using automatic vehicle identification technology. This technology bills toll road users by mail, a collection method already in use on the Coronado Bridge in San Diego. “Smart cards” and electronic license plates, linked to computers, can record the

passage of every car through toll recorders without affecting traffic flow. Tolls are tallied and billed monthly.

In addition, a congestion pricing structure is being developed for the expansion, which will charge travelers more to use the road during hours of peak traffic than at off-peak times. A demonstration of congestion pricing is particularly important because there is little experience with this technique in the United States. Simulation models indicate this method could reduce volatile organic emissions and gas emissions by 8.2 percent.⁵ Construction of the expansion is expected to begin early in 1992.

Ridesharing Programs Reduce Traffic Congestion and Exhaust Emissions

The Connecticut Department of Transportation is one of many state transportation agencies reducing both traffic congestion and vehicular pollution through ridesharing programs. Carpooling and vanpooling in Connecticut are promoted by nonprofit brokerages that also encourage the use of public transportation. The brokerages offer ride-matching services, distribute mass transit information, arrange low-interest loans and leases for vans used for pooling, and evaluate potential ridership for proposed bus and rail improvements.⁶

Approximately 70 percent of the funding for brokerages comes from federal highway funds administered through the state, and 30 percent comes from corporate sponsors and private sources. In 1989 the brokerages received a \$500,000 Employer Challenge Initiative Grant from the state's fuel oil overcharge funds. The grants were used over a two-year

period to increase employer commitment to promoting ridesharing, providing an alternative to free employee parking. In southwestern Connecticut, for example, the first eighteen months of the program produced an average public contribution of \$2,500, but an average employer contribution of \$6,000. In effect, the grant establishes a program that is perpetuated independently by the employer.

The ridesharing programs in Connecticut have set up more than 12,000 carpools and 180 vanpools. Each year, they save an estimated 19 million gallons of gasoline and reduce annual vehicle miles traveled (VMT) by about 341 million. These savings equate to roughly 950 tons each of hydrocarbons and nitrogen oxides, and 5.7 tons of carbon monoxide.⁷

New Jersey has a different approach to increasing vehicle occupancy and reducing air pollution. The New Jersey Traffic Congestion and Air Pollution Control Act, signed into law on June 30, 1992, requires the state transportation department to establish a Travel Demand Management Program for designated areas.⁸ Under the program, companies with 100 or more employees at a single work site will have to increase the average number of passengers per commuter vehicle to 25 percent above the regional average occupancy rate. This will be accomplished by providing workers with commuter benefits that encourage ridesharing, bicycling, and use of public transportation. Employers can deduct the cost of these benefits from their taxes as a business expense.

By 1993, the departments of Transportation and Environmental Protection

and Energy must determine which areas of the state will be subject to the Travel Demand Management Program. Covered employers will be required to file compliance plans by November 1994 and demonstrate achievement of the 25 percent standard by November 1996. Filing fees and penalties for noncompliance will finance the program.

Road Salt Alternative Prevents Harmful Runoff

The Massachusetts Department of Transportation has found that using a substitute for conventional road salt can prevent groundwater contamination from harmful runoff. In 1988 the department learned of sodium levels of 250 to 300 parts per million in private water wells near a stretch of state highway. The contamination resulted from the department's application of road salt, or sodium chloride, to the highway to control ice. Because the property lot sizes and septic system regulations precluded replacing the contaminated wells, the department decided to substitute calcium magnesium acetate for the sodium chloride. Since the switch, sodium levels in all of the contaminated wells have dropped to below 70 parts per million.

The transportation department stopped applying sodium chloride to another section of highway as well, to prevent runoff damage to cranberry crops. While calcium magnesium acetate costs fifteen to thirty times more than traditional road salt, its higher price may be more than offset by the savings from avoided water and land pollution.

Enclosed Sand Blasting for Bridge Maintenance Captures Lead Paint
Concern over releases of lead to the

environment caused the North Carolina Department of Transportation to suspend bridge maintenance painting activities on all structures with lead paint in 1985. This type of maintenance usually involves sand blasting to prepare the bridge for repainting, which causes the lead paint to either flake off or be ground into dust. In these forms, lead paint is easily released to the surrounding air, water, and land. Exposure to this lead in the environment causes neurotoxic effects, and studies have shown that even low levels of exposure can stunt a child's physical development and cause learning problems and hyperactivity.

To eliminate the potential for this environmental lead exposure, in 1986 and 1987 the state evaluated various alternatives to sand blasting and determined that using contained sand blasting techniques was the best alternative for removing severely deteriorated paint. Contained sand blasting involves wrapping the area to be blasted and maintaining a slight vacuum within the wrap during paint removal operations. The vacuum collects the paint particles and thus eliminates uncontrolled releases of lead to the environment. The system also separates the sand and lead, reducing the volume of lead-contaminated waste for disposal. Then the separated abrasive material is recycled and used to remove more paint. Ultimately the material is used to manufacture asphalt concrete pavement.⁹

Energy Departments and Public Utility Commissions

Pollution from the consumption of energy has a major impact on the environment, primarily through air emissions caused by burning fossil fuels.

During the last decade, state energy offices and public utility commissions have actively promoted conservation to reduce energy demand and prevent pollution. Energy offices have taken the lead in developing statewide long-term energy plans, which lessen the need for building new power plants and reduce the amount of pollution generated for each dollar of economic activity. Public utility commissions offer consumers financial and technical assistance to reduce their energy use, establish building and appliance codes to require energy efficiency, and create incentives for utilities to institute demand-side management plans.

Energy Plans Promote Energy Efficiency Measures

New York has a comprehensive energy planning process, established by executive order in 1988 and undertaken by the state energy office in cooperation with the departments of Public Service and Environmental Conservation.¹⁰ The plan must be updated at least every two years. It provides an assessment of the state's energy future; evaluates various options for meeting energy needs; identifies policies to guide energy decisionmaking; and recommends actions for implementing them, while integrating environmental and economic considerations.

The 1991 plan update recommends methods for improving energy efficiency in building construction, transportation, and utility planning. For example, the plan suggests:

- expanding the state home energy rating system to encourage residential building improvements to conserve energy;

- reducing vehicle miles traveled by promoting preferential parking for carpools, providing secure bicycle parking at commuter stations, and instituting high-occupancy-vehicle lanes on commuter highways;
- continuing implementation of aggressive electric utility demand-side management programs; and
- accounting for environmental externality costs, where possible, in energy decisions.

To augment the plan, Governor Mario M. Cuomo's executive order issued in January 1990 called on New York's 8,000 state facilities to reduce their energy consumption by 20 percent by 2000. A year later, the New York Power Authority established a program to accelerate progress toward that goal by providing off-budget funding for limited capital projects. The program uses the power authority's bonding and incentive payments available through utilities to finance energy-efficient improvements in state buildings. The state energy office helps to identify facilities and projects for funding and also provides its own capital for energy efficiency projects.

Virginia's state energy plan is another example of government efforts to increase energy efficiency and conservation and promote renewable and alternative sources of energy. In addition to saving money for the state, the plan recognizes that efficient use of energy can eliminate some adverse effects on the environment.¹¹ The Virginia energy plan requires:

- adopting an energy management plan for each state agency to reduce energy consumption by 25 percent in 1998 measured against 1990 levels;
- converting 10 percent of local government fleets to electricity, ethanol, or compressed natural gas and fifty vehicles in the state's fleet to compressed natural gas; and
- integrating energy education in the curriculum for kindergarten through twelfth grade.

Loans and Tax Credits Increase Energy Conservation

The Oregon Department of Energy promotes energy conservation through a variety of economic incentives. Through the Business Energy Tax Credit Program, the state offers a 35 percent tax credit for projects that use recycling, renewable resources, or product reuse to save energy. The tax credits can be taken over five years for projects costing up to \$40 million each year. Through 1989, the program provided tax credits totaling more than \$165 million to 2,003 projects.¹²

Oregon's Small Scale Energy Loan Program (SELP) provides low-interest, long-term loans to individuals, small businesses, nonprofit groups, cities, counties, and state agencies. The loans finance conservation and renewable resource projects, such as recovering methane from waste to use for energy or using wood wastes to replace diesel oil. SELP also offers a Public Energy Package to finance the cost of identifying energy-saving projects for local government and state agencies, provided they

agree to implement the energy measures found through the package. In addition, SELP lends matching funds to schools and hospitals that are applying for federal grants that require a match. The energy department finances SELP through the sale of Oregon general obligation bonds. Through 1989, SELP had provided loans to 290 projects for a total of \$159,403,303.

Oregon's Residential Tax Credit Program encourages homeowners to use renewable resources. The homeowner receives a tax credit based on the amount of energy saved through home solar, wind, hydro, and geothermal systems. This is the only such program in the nation that is based on performance. The credit provides 60 cents per kilowatt-hour saved in the first year; thus, if the system saves 1,000 kilowatt-hours the first year, the tax credit is \$600. The top credit today is \$1,500. For solar pool or spa heaters, the credit is 15 cents per kilowatt-hour saved, up to 50 percent of the system cost. Through 1989, the Residential Tax Credit Program had given tax credits to 14,014 homeowners.

The Oregon Department of Energy estimates that these three programs have produced energy savings of more than 210 average megawatts of electricity, 50 million therms of natural gas, and 167,000 barrels of distillate oil.

New Building Codes Reduce Energy Consumption

Effective March 1, 1991, amendments to the New York State Energy Conservation Construction Code strengthened minimum energy efficiency standards for the design of all new buildings and additions or renovations to existing buildings.¹³

The new standards are expected to reduce energy use in affected buildings by 14 percent, saving a total of 500 megawatts of electricity demand (roughly half the capacity of a full, baseload nuclear power plant) by the year 2000. These savings will offset increased construction costs required by the code changes; for commercial buildings, the costs can be recovered through energy savings within three years.

The code amendments also include the nation's first state efficiency requirements for lamps, lighting fixtures, and motors, recognizing the important role of lighting equipment in improving overall building energy efficiency. Lighting in New York's commercial buildings consumes more electricity than does the state's entire industrial sector. The amendments are expected to reduce annual energy consumption in new high-rise office buildings by more than 30 percent over 1979 energy code levels for lighting, cooling, heating, ventilation, and water heating.

Demand-Side Management Keeps Electricity Generation Down

Demand-side management (DSM) is a technique for meeting customer needs for energy by reducing and altering the timing of demand rather than increasing supply. DSM programs increase the efficiency with which electricity is used and shift electricity usage from peak periods to off-peak periods by providing energy efficiency audits and financing energy improvements. This reduces average customer bills while preventing emissions of pollutants from burning fossil fuels.

DSM is a key component of the New York State Energy Plan. In 1989 the plan's goal was to reduce energy demand by 8 to 10 percent by the year 2000 and by as much as 15 percent by 2008 (if economically justified). These goals signaled a policy shift from emphasizing reduced peak electricity demand to stressing energy efficiency. Beginning with their 1991 program plans, all of New York's electric utilities are conducting full-scale demand-side management programs.

The first measurable DSM savings were realized in 1986, with a peak reduction of 25 megawatts. In 1990 the DSM programs achieved a peak reduction of 313 megawatts and an annual energy savings of 268 gigawatt-hours. In 1992 the utilities expect to save 1,948 gigawatt-hours. Expansion of electric DSM programs is encouraged by rate regulations that allow utilities to recover conservation program costs and net revenue losses, and also to earn an incentive on successful DSM programs. The New York Public Service Commission directed the utilities to propose incentive plans that award an additional return on equity or allow the utility to retain a portion of the DSM-produced cost savings. This ensures that the utilities suffer no net revenue loss for selling less electricity as a result of their DSM programs.

Super Efficient Bulbs Save Energy

The Maine Public Utility Commission has a DSM program that prompted Central Maine Power's promotion of super energy-efficient light bulbs. The company distributed \$9 discount coupons for the bulbs to its 450,000 customers, and worked with three major

retail store chains in their service area to stock the bulbs. The light bulbs usually cost between \$19 and \$24, but competition among manufacturers and retailers in the program served to reduce the final price to the consumer (including the discount coupon) to between \$4 and \$5—allowing a payback in energy savings within an average of six months.¹⁴

Assuming that fossil fuels are used to generate the electricity, over its seven-year life, each bulb prevents 1,500 pounds of carbon dioxide and twenty pounds of sulfur dioxide emissions from entering the air. The 165,000 bulbs sold in 1991 will eliminate 123,750 tons of carbon dioxide and 1,650 tons of sulfur dioxide from the environment over their life. Central Maine Power anticipates that it will save six megawatts of generating capacity, enough to power the residential needs of a medium-sized Maine town. The company estimates that the use of these energy-efficient bulbs will result in a total energy savings of 126 million kilowatt-hours of electricity, representing a savings of \$13 million.

Agriculture Departments

Agricultural practices produce significant environmental effects, primarily through application of fertilizers and pesticides to the land. Nonpoint source pollution to surface and groundwater results from runoff and soil depletion from fields, presenting the greatest opportunity for agricultural pollution prevention. In addition, agriculture and related industries consume substantial energy and produce significant air emissions from burning fossil fuels. Faced with contaminated groundwater, exhausted soils, and the desire for energy conservation,

many state agriculture departments are exploring and implementing innovative practices that prevent pollution.

Sustainable Agriculture Prevents Nonpoint Source Pollution

Preventing nonpoint source pollution from agricultural chemicals requires either finding alternatives to application of these chemicals to the land, or finding ways to remove excess fertilizer and pesticides before they contaminate soil and water. The Leopold Center for Sustainable Agriculture at Iowa State University studies both. The Iowa legislature established the center under the 1987 Groundwater Protection Act to conduct research on sustainable agriculture, which the law defines as "the appropriate use of crop and livestock systems and agricultural inputs supporting those activities which maintain economic and social viability while preserving the high productivity and quality of Iowa's land."¹⁵

In its first four years, the center has awarded more than \$3.2 million in more than sixty-five competitive grants throughout the state, and has established four interdisciplinary research teams to develop new farming systems and address issues of importance to Iowa farmers. One of these teams studies integrated pest management (IPM), which places a priority on the role of biological control and natural plant resistance over the use of chemicals to control pests.

Biological control employs the action of natural enemies, while use of natural plant resistance involves the development of plants with inherited characteristics that enable them to repel an insect or its damage. Both tactics result in reduced

costs and less environmental pollution or ecological disruptions. The IPM team currently is studying alfalfa pests, biological control agents that attack the alfalfa weevil, and other IPM practices. In other cases, products that are more environmentally benign than traditional fungicide are being studied for plant protection. The center is investigating replacing the fungicides used on Iowa's seed corn with a degradable polymeric seed coating as an environmentally safe alternative. Polymeric films also can help keep seeds from taking up moisture when stored at high humidity. These methods further reduce the use of pesticides when combined with techniques such as altering planting or harvesting dates, using conservation tillage practices, and rotating crops. These practices, which also control soil erosion, have been shown to be effective on a small scale and are being studied for broader application.

Once pesticides and fertilizers have been applied, new methods may be used to take up runoff to prevent leaching of these chemicals into the soil and water. For example, the Leopold Center planted poplar trees in a buffer zone between a creek and a corn crop to use the natural ability of the plants to remove nitrate from groundwater and convert this nitrogen into a usable, renewable crop. Their research shows that poplar trees can be cultured at densities similar to those of corn, with roots grown intentionally deep enough to intersect the near-surface water table. Data indicate that a substantial mass of nitrate is removed from rooted soils, and the nitrogen becomes protein in the leaves and woody stems of the plants.

Efficient Agricultural Practices Can Curb Energy Consumption

The Georgia Governor's Office of Energy Resources for nearly a decade has been an advocate for energy conservation in the agriculture sector. Agriculture is Georgia's economic base, accounting for \$30 billion in annual sales and employing more than 33 percent of the workforce. By facilitating six programs targeted to crop, poultry, and livestock producers, the office has helped increase energy and agricultural efficiency. These efforts not only conserve energy and save money, but also result in significant reductions in air pollutant emissions.¹⁶

Since the early 1980s, the Office of Energy Resources has worked through the Cooperative Extension Service at the University of Georgia to assist individual farmers. With the receipt of oil overcharge funds in 1987, the office also began working through the Georgia Institute of Technology to lend technical assistance to agricultural processors. Georgia Tech staff engineers analyze systems of all types and recommend energy-saving measures. For a relatively small investment of \$200,000 a year, the projects under these two programs achieve impressive results and indicate even greater potential.

One project of the Cooperative Extension Service involves energy analysis of Georgia's dairy farms, with an emphasis on more efficient heating of wash water and cooling of milk. Through the use of a heat exchanger, milk heat can be used to warm wash water. Cold well water can partially cool the milk as it comes from the cow through another type of heat exchanger. It takes approximately

two years for energy savings to recoup the cost of the equipment, which lasts for approximately twenty years. To promote these simple adaptations, a Dairy Grant Program offers up to \$2,000 per dairy farmer for the purchase and installation of the heat exchangers. The dairy program has shown an annual savings of \$100,000 and approximately 1.25 million kilowatt-hours of electricity. If all of the state's dairies installed the equipment, they would save 10.5 million kilowatt-hours of electricity each year.

Under another project aimed at the poultry industry, on-site energy evaluations of broiler houses result in recommendations for installing energy-efficient insulation and lighting and improving equipment maintenance. Through this project, energy consumption in more than 12,000 broiler houses has been reduced an average of 20 percent, saving \$10 million in energy costs annually. Roughly half of this savings is in approximately 62 million kilowatt-hours of electricity.

The Resource Conservation and Development Council of Georgia also contributes to the efforts of the Office of Energy Resources by administering a program that promotes the "no-tillage" method of planting. No-tillage drills are used to place new seeds into soil without destroying existing vegetation, not only saving fuel but also reducing soil erosion by eliminating the need to plow the land. The Georgia No Tillage Assistance Program is helping farmers restore drought-stricken pasture land to life. Annual funding of \$700,000 from the Office of Energy Resources enables the Georgia Soil and Water Conservation Commission to purchase no-tillage

agriculture equipment and make it accessible to farmers through local soil and water conservation districts. No-tillage techniques save oil by reducing tractor fuel consumption from five gallons per acre to a half gallon per acre. Through June 1990, more than 36,000 acres had been planted using the no-tillage method, saving 151,200 gallons of gasoline. However, some studies caution that no-tillage farming may require a substantial increase in fertilizer application to maintain crop yields.

Economic Development Agencies

State commerce departments and economic development agencies are exploring business incentives to spur pollution prevention. These efforts recognize that traditional economic goals, such as creation of jobs and tax revenues, need not be at odds with the objectives of sound environmental stewardship. In fact, they should reinforce one another. Economic development agencies have resources to enable businesses to undertake pollution prevention projects, whether through financial aid and incentives, tax breaks, or technical assistance. By assisting companies in reducing or eliminating environmental discharges, departments of commerce help lower the costs of environmental compliance and waste management, thus increasing the companies' profits and ability to compete.

Economic development agencies also are devising innovative ways to attract and retain companies with good environmental records or the ability to provide environmental services to their states. By recruiting "environmentally friendly" businesses, the state can see that jobs

and taxes are not generated at the expense of the state's health, natural resources, or recreational attractions.

Green Industries Initiative Boosts Pollution Prevention

In Delaware the Green Industries Initiative promotes waste reduction and use of recycled materials. Announced by Governor Michael N. Castle in December 1991, the program will reward companies that have demonstrated success in pollution prevention (see box on

Qualifying for the Green Industries Initiative in Delaware). It provides special tax incentives, financial aid, and technical assistance. The state developed the program through a memorandum of understanding between the Delaware Development Office (DDO) and the Department of Natural Resources and Environmental Control (DNREC).¹⁷

Corporate income tax credits and gross receipts tax reductions for Delaware firms and firms moving to Delaware have been

Qualifying for the Green Industries Initiative in Delaware

To receive benefits through the Green Industries Initiative, a company must meet the requirements within one of the following categories.

Source Reduction

A company must show it has voluntarily reduced its waste generation by 20 percent for Toxics Release Inventory chemicals or by 50 percent for other wastes. The reduction must be documented in a source reduction plan and may not be the result of regulatory or legal requirements. Qualifying companies will receive corporate income tax credits of \$250 for each 10 percent increment of waste reduction, and small businesses may receive direct loans of up to 25 percent of a total package, not to exceed \$100,000.

Utilization of Recycled Materials as Inputs, Processing of Materials, or Collection and Distribution of Materials

A company must use production inputs composed of at least 25 percent recycled materials or materials removed from the municipal solid waste stream; serve as a processor of materials removed from the municipal solid waste stream for resale as manufacturing inputs; or collect and distribute either recycled materials or materials removed from the municipal solid waste stream for the purpose of recycling.

For a minimum investment of \$200,000 and the creation of five jobs, eligible companies may receive a tax credit of \$500 for each \$100,000 invested and \$500 for each new employee for whom at least \$40,000 has been invested. For the first five years of operation, the companies also are exempted from the gross receipts tax on products that use recycled inputs. After five years, this exemption would be reduced by 10 percent per year for ten years. In addition, participants may apply for loans of up to 25 percent of a total package, not to exceed \$100,000.

made available through legislation approved in January 1992. Financing assistance for fixed assets and working capital can be provided through the Small Business Revolving Line of Credit and Enhancement Fund.

Technical assistance offered by DDO and DNREC helps companies select sites and determine regulatory requirements; provide tools for employee education, recruitment, and training; expedite the company's environmental permits; perform an environmental compliance audit (with emphasis on correcting deficiencies rather than enforcing regulations); assist in locating markets for recycled materials; provide access to state and national case studies; and support businesses in seeking other state and local approvals for operation.

Revolving Loan Fund Finances Pollution Prevention Projects

The Connecticut Development Authority (CDA) is working with the Connecticut Hazardous Waste Management Service to implement an environmental assistance revolving loan fund, which will augment the pollution prevention program established in 1988. The fund will provide loans for completed pollution prevention projects to small businesses with gross revenues of less than \$25 million (in the most recent fiscal year) and fewer than 150 employees.¹⁸

CDA has adopted procedures businesses must follow to obtain this assistance. In addition, the Hazardous Waste Management Service will consider adopting procedures establishing eligibility criteria applicable to CDA loans. Another state agency, the Department of Economic Development, will be responsible for

charging and collecting interest on the loans at a rate to be determined in accordance with adopted procedures. Funding for the loans will come from bonds of up to \$10 million issued by the state bond commission.

Connecticut also has established an Office of Business Ombudsman in the Department of Environmental Protection to provide information to businesses on environmental programs and requirements, and to serve as a liaison between the department and programs affecting business. In the Connecticut Hazardous Waste Management Service, an Office of Environmental Business Assistance will provide technical assistance to business in pollution prevention techniques and methods. The service will give priority to the needs of small businesses in providing assistance and will coordinate its activities with private and public sector pollution prevention efforts.

Business Experts Lend Pollution Prevention Advice

The Nevada Small Business Development Center (NSBDC) has created a Business Environmental Program to educate small businesses in waste disposal and pollution prevention techniques. As part of the College of Business Administration, University of Nevada at Reno, NSBDC is in a unique position to assist businesses that are skeptical of seeking assistance from an environmental regulator. The center combines knowledge of business concerns with an understanding of environmental regulation.

The program provides on-site technical evaluations and operates a toll-free number for delivering individual assistance to businesses. It utilizes experts

from other available resources such as faculty, county, state, and federal agencies, and private industry. The program's services are not limited to small businesses, and NSBDC uses the university system, the Agricultural Extension Service network, and selected chambers of commerce to reach as much of the business community as possible. NSBDC's hazardous waste technical assistance efforts are coordinated with the Nevada Division of Environmental Protection.

Environmental Scorecard Awards Tax Exemptions to Best Environmental Stewards

In 1990 Louisiana created a novel approach to tying existing industry tax exemptions to environmental performance and pollution prevention efforts. Although the controversial "environmental scorecard" was cancelled by Governor Edwin W. Edwards in 1992, its proponents and detractors continue debating the effects of directly linking economic and environmental policy.

Before the scorecard was devised, the Louisiana Board of Commerce and Industry sought to create jobs by granting ten-year exemptions from state and local property taxes to companies that expanded or upgraded their facilities in the state. However, state environmental officials complained that the exemptions, totaling nearly \$300 million a year, were in large part granted to capital-intensive companies that created few jobs. Moreover, some of the greatest beneficiaries of the tax exemption were the largest generators and emitters of pollution, including some of the chemical, petroleum, and paper industries that predominate in Louisiana. These officials argued that tax breaks granted to polluting

industries could actually offset environmental noncompliance penalties, interfering with environmental enforcement.

These concerns led to regulations that made 50 percent of the tax exemption contingent on a company's environmental compliance records and toxic emissions. Based on their rating on an environmental scorecard, companies with the best records that provided the highest number of jobs per pound of toxic emissions or criteria air pollutants would receive up to 100 percent of the tax exemption. A company's compliance score was not based on paperwork violations, but rather on fully adjudicated violations involving major spills and discharges that clearly threatened environmental quality. Bonus points on the scorecard were awarded for helping to diversify the state's economy; providing jobs in high-unemployment areas; and implementing approved emission reduction plans.

The scorecard's potential impact is illustrated by a company whose rating once translated into a \$7.2 million loss—about 100 times the amount of a typical fine for environmental violations. Within thirty-one days of receiving the rating, the company's corporate headquarters submitted a pollution prevention plan to the state—even though previously its management had estimated it would take eighteen months to develop such a plan. From December 1990 to January 1992, twelve companies submitted plans to reduce their Toxics Release Inventory emissions, raising their average score from 82 to 94. Their plans included a commitment to reducing their toxic emissions by 36.3 million pounds and

their criteria air emissions by 141.8 million pounds.¹⁹

For some companies, the tax exemption was incidental compared with the public recognition gained by a high environmental score. The high score of a competitor could motivate companies to try to match or beat it. High scores also served as a source of corporate pride in sound environmental management.

While its proponents viewed the scorecard as a way to use tax breaks as a pollution prevention incentive, others saw the scorecard as an unnecessary hammer that threatened companies with economic penalties outside traditional enforcement. Scorecard opponents questioned the validity of forcing an economic development agency into the business of penalizing industry. And rather than fostering corporate pride in high scores, the program's detractors believe it created only negative perceptions among businesses and the public for companies that could not achieve scores of 100 percent. Furthermore, former Governor Buddy Roemer instituted the scorecard rule over the objections of a legislative oversight committee, which signaled reservations about the program in the state legislature. Since no other state has adopted a similar program, there is only limited evidence to prove that a policy of linking tax breaks with environmental performance can succeed.

State Enforcement Offices

The office of the state attorney general and other state enforcement offices can provide powerful pollution prevention incentives for companies subject to consent decrees. The New York attorney

general's office has begun to consider pollution prevention remedies when adjudicating violations of the state's environmental laws. The efforts of the attorney general's office complement the Department of Environmental Conservation's pollution prevention program.

The state used this approach in a consent decree signed by Eastman Kodak Company in April 1990. The decree was the product of nearly two years of effort by a multi-disciplinary team of geologists, engineers, and attorneys, which administered ongoing regulatory programs, conducted inspections, reviewed remedial workplans, and oversaw remediation efforts at the Kodak facility. The order charged Kodak with several violations of the Environmental Conservation Law, including exceeding air emissions limits, violating water pollution standards, and failing to report spills or releases of hazardous materials in a timely fashion. The company consented to the order, waiving the right to a hearing and agreeing to pay a \$1 million penalty.

The pollution prevention component of the consent order called for Kodak to prepare within six months a code of management practices, which specifically addresses waste and release reduction. This code included methods of achieving source reduction, such as equipment purchases and operation and maintenance programs; a tracking system to measure progress in reducing releases; an annual report summarizing release reduction progress; and release reduction education and training programs for employees.

Another consent order, signed by Schenectady Chemical in December 1991, prescribed pollution prevention measures

to address surface water discharges in violation of its state pollution discharge elimination permit as well as unpermitted air emissions. Under the order, the company must develop and implement a best management practices plan at all four of its facilities, with the goal of preventing or minimizing the release of hazardous or toxic substances into the waters of the state; providing timely notification to the Department of Environmental Conservation of such releases; assessing the need for emergency equipment and other procedures necessary to respond to releases; and, at one of the facilities, instituting a storm water management and spill prevention plan.

These consent orders included strict timetables for completion of environmental audits, work plans, and reports, which require approval by the Department of Environmental Conservation. The orders required demonstrated results and carried heavy fines for failure to comply. Thus, while the facilities involved benefit from lower fines and a healthier public image for adopting pollution prevention measures, the state is able to apply extraordinary pressure on the facilities to see that their efforts succeed.

The California Department of Toxic Substances Control has had similar success in incorporating pollution prevention into its consent agreements. For example, in 1988 the department entered into a consent agreement with a company that included a penalty of \$8.95 million. Of this, \$3.95 million was to be retained by the company to perform a waste reduction audit and to implement its recommendations. The audit included identification of sources, wastes, and quantities of both hazardous waste and

other pollutants and evaluation of potential source reduction techniques.

The strategy of allowing the company to employ waste reduction to receive partial credit for the penalty was successful in three ways. First, the total amount of time between filing the complaint against the company and signing the consent order was just five days—an extraordinarily brief period. Second, the resulting waste reduction audit revealed three cost-effective waste minimization methods. Finally, the company ultimately spent nearly \$10 million more than the original \$4 million to implement the pollution prevention measures, far exceeding the requirements of the original order.

State Educational Institutions

State universities and colleges, and sometimes even public elementary and secondary schools, have begun providing education on pollution prevention practices. For example, the Florida State Board of Community Colleges has asked the Department of Environmental Regulation to develop a pollution prevention curriculum, which will apply toward an associate degree for environmental technician, and also train instructors in pollution prevention methods. The final product will be a "Pollution Prevention Through Waste Reduction" training curriculum module that can be incorporated into science, environmental education, or other related courses, including vocational, job-preparatory, or supplemental courses.

The department is initiating the development of at least three business and industry curriculum modules and will

develop a curriculum that can be incorporated into other educational programs along with the A.S. degree. The department also will train instructors in using the developed curriculum. In addition, existing community college courses that train workers in businesses and industries that use hazardous materials will be identified and promoted.

In Delaware a multidisciplinary curriculum is being developed for grades nine through twelve, and the state environment department is cooperating with the University of Delaware and other educational institutions in creating courses on pollution prevention for both college and continuing education students.

Multi-Agency Coordination

As pollution prevention policies are implemented in a range of state agencies, coordinating their efforts becomes increasingly important to see that programs reinforce one another and do not work at cross-purposes. Several states have established interagency task forces to foster this coordination among state agencies and some private organizations as well. These committees can facilitate communication and even establish consensus on the direction pollution prevention efforts should take.

The **Ohio Pollution Prevention Development Work Group**, established by Governor George V. Voinovich, promotes pollution prevention in state government operations, the business community, and consumer activities. The work group's major objectives include developing a comprehensive pollution prevention strategy for Ohio; establishing pollution prevention plans for each state agency

and department; increasing communication related to pollution prevention among state agencies, business, and the public; and reviewing and commenting on state pollution prevention legislation.

The work group consists of two groups—a policy group composed of state agency and department directors and a technical group composed of state agency and department staff. The technical group prepares specific projects and reports for review by the policy group and the Governor's office. Participating state agencies include the departments of Education, Agriculture, Natural Resources, Development, Transportation, Industrial Relations, Administrative Services, and Health; the Board of Regents; the Industrial Commission of Ohio; the Public Utilities Commission of Ohio; and the Ohio EPA.

Initially the technical group will assess pollution prevention activities underway in all agencies and departments, identify pollution prevention opportunities in the agencies, and determine which agency authorities could be used to implement various pollution prevention initiatives.

The Delaware Waste Minimization-Pollution Prevention Committee was established by the state Department of Natural Resources and Environmental Control in 1990. The committee meets monthly and includes the state administrative, agriculture, development, education, transportation, and solid waste agencies, as well as state universities and colleges, the Delaware Chamber of Commerce, public interest groups, the League of Local Governments, the Chemical Industry Council, and Delmarva Power & Light. The committee is actively

involved in the state's Pollution Prevention Program, which is charged with targeting industries and locations for technical assistance; providing waste minimization and pollution prevention education and outreach; and developing a statewide recycling program.

A state law enacted in 1989 created the **Texas Waste Reduction Advisory Committee** to advise the state Water Commission on waste reduction and pollution prevention. The nine-member committee includes representatives of environmental and public interest groups and regulated industry. In February 1990 the committee began a review of state and federal programs that affect hazardous waste generation and devised a workplan with a primary goal of source reduction and a secondary goal of waste minimization. The committee's policy statement and supporting recommendations ultimately were enacted as the Hazardous Waste Reduction Act of 1991 (Senate Bill 1099).

Another committee of environmental groups and industry representatives was established in October 1991 to advise the Texas Water Commission and Air Control Board in developing rules to carry out Senate Bill 1099. Following public comment on the draft rules, the committee worked with Water Commission and Air Control Board staff to devise the final rules, which were adopted in December.

Taking a Multi-Media Approach to Reducing Pollution

Over the past several decades, environmental protection efforts have emphasized controlling pollution on a “one pipe at a time, one environmental medium at a time” basis. This single-medium focus has a long history, beginning with the federal Water Pollution Control Act of 1948. More recently, comprehensive pollution controls for each environmental medium were established with the Clean Air Act Amendments; the Clean Water Act; the Resource Conservation and Recovery Act; and numerous other laws addressing particular pollutants and environmental media (see Appendix C).

The evolution of environmental laws has led to a concentration on individual facets of environmental protection. Thus, air pollution regulators focus on stack discharges; water control personnel focus on pipe effluents; and hazardous waste regulators track waste generation and disposal, with each regulator unaware of the others’ activities and goals. These isolated programs produce separate regulations without consideration of net environmental benefit or total facility cost. Moreover, the implementation schedules of these regulations rarely coincide, frequently requiring companies to revise their compliance strategies. Different programs also impose their own reporting requirements, with the resulting information housed in separate databases.

Not surprisingly, industry responds to this patchwork process by controlling the particular discharge as it is regulated. Plant managers lower pollution at one outflow, sometimes at a cost of raising it elsewhere in the plant (for example, when air pollutants are “scrubbed” from stack gases they often end up as solid or

hazardous waste sludges). Little is done to encourage an examination of the overall production process to find pollution reduction opportunities; instead, regulations foster a “band-aid” approach to pollution control. Even some waste minimization efforts have fallen into the same trap. By focusing on one medium, they may ignore the inadvertent creation of pollution increases elsewhere in a facility.

The effect of this single-medium, single-pipe approach can be a failure to achieve net pollution reductions even in the face of ambitious standards and costly controls. The multi-media approach attempts to rectify these shortcomings by looking at the whole facility when assessing pollution and choosing control options. At the very least, it can help identify the most cost-effective mix of controls if pollution cannot be avoided. At best, this approach can reveal opportunities to avoid pollution altogether. Even a single-focus source reduction program—such as one directed at only hazardous waste—can benefit from a multi-media approach that keeps waste reduction in one area from translating into pollution increases elsewhere in the plant.

A multi-media approach and pollution prevention programs are not interdependent; they reinforce one another. This “big picture” view of environmental management forms the cornerstone of pollution prevention efforts.

The Elements of a Multi-Media Approach

Implementing a multi-media pollution prevention program requires information on plant releases of all pollutants to all

environmental media and coordination within and among the various regulatory programs. The first requirement calls for accurate, comprehensive emission inventories. Many federal- and state-maintained inventories presently are operating and their quality is improving, but more work is needed to integrate them. For regulatory coordination, states must develop new techniques and train or hire staff to perform new duties. In this area, states are moving ahead.

Understanding What Is Emitted and Where Emissions Go

To assess fully pollution prevention opportunities, government and business must know the quantity of pollutants discharged by each process and where the emissions go. Federal and state agencies long ago established large databases on environmental pollutants, but most meet only the needs of single-medium programs. Air regulators track air pollutants, water regulators track water effluents, and so forth. Differences in definitions, collection techniques, and facility identification codes hamper efforts to tie this information together. Thus, few regulators have knowledge of every type and quantity of pollutant emitted by different facilities or industrial groups.

The Toxics Release Inventory (TRI), compiled by EPA under federal statute, provides the first opportunity to correct this deficiency. The TRI regulations require manufacturing facilities to report annually to EPA the releases and transfers of more than 320 toxic chemicals (see box on the Toxics Release Inventory). Each facility must report how many pounds of each substance were released to the environment (e.g., to air, water,

The Toxics Release Inventory Database

The Toxics Release Inventory (TRI) was established under Title III of the Superfund Amendments and Reauthorization Act of 1986. The most recent reporting requirements of 1989 covered 320 individual toxic chemicals and twenty categories of chemical compounds. Facilities reported if they met the following conditions during the year:

- They manufactured, processed, or imported more than 25,000 pounds of any of the covered chemicals or used 10,000 pounds or more of a covered chemical.
- They were classified within standard industrial classification (SIC) codes 20 through 39.
- They employed the equivalent of ten or more full-time employees.

Each facility had to report all releases and transfers, including:

- emissions of listed materials to the air;
- wastewater discharges into rivers, streams, or other bodies of water;
- releases to land on site, including landfills and surface impoundments;
- disposal of wastes into underground injection wells;
- transfers of wastes to public sewerage plants; and
- transfers of wastes to off-site facilities for treatment, storage, or disposal.

In 1989, 22,569 facilities submitted TRI forms; the environmental releases and transfers reported by these facilities totaled 5.7 billion pounds, down by 549 million pounds from 1987.²¹

or land) or sent off site for recycling, treatment, or disposal. Because the data are classified using standard industrial codes, they can show the total pollution burden of single plants or whole industries. Such information allows regulators to better focus resources, and the public disclosure of the data helps spur industry toward voluntary reductions of releases.

States are beginning to use the TRI data alone, and in combination with other information, to establish their own master files of facility discharges. For example, the Massachusetts Bureau of Waste Prevention (part of the Department of Environmental Protection) is combining electronically for the first time twenty-eight separate agency databases, which

cover 45,000 regulated entities. This new combined database will allow a whole-facility look at roughly 20,000 facilities regulated by the state. Such efforts are helpful in coordinating inspection and enforcement programs. However, data consolidation requires reconciling conflicting information in various databases; for example, facilities often are known under different names depending on the file, and different corporate and plant addresses are sometimes used interchangeably.

On a broader level, multi-media inventories such as TRI are useful in developing a strategic environmental plan. Strategic plans attempt to develop a more methodical, focused approach to allocating resources to environmental problems. State strategic plans usually identify broad priorities of local concern, such as point source discharges to water (e.g., in Washington) and coastal wetlands loss (e.g., in Louisiana).²⁰ TRI data can help a state roughly gauge the magnitude of risk imposed by a particular pollutant in each medium it contaminates. This can help shape the state's environmental objectives, including its pollution prevention goals.

Coordinating State Activities to Achieve a Multi-Media Focus

A multi-media approach must coordinate the existing functions of individual environmental programs. Each program's different mandates, staff, and goals must be brought together, as some states are doing through inspections, compliance monitoring, and permit review.

Inspections and Compliance Monitoring

The first priority of facility inspections is to check for compliance with regulations. However, inspections—particularly multi-media inspections—offer a unique opportunity to review plant operations and identify whether process changes could reduce pollution.

Traditionally, regulatory programs have hired and trained their own inspectors, who are sent on assignment to uncover violations in their specific program area. This has led to inefficiencies, since each facility must deal with four or more separate visits. Moreover, it is not uncommon for an inspector from one program to completely miss a violation in another medium—or worse, deliberately ignore it. As Dan Greenbaum, commissioner of the Massachusetts environment agency, recently stated: “We actually had a case where an air pollution inspector showed up at a site and stepped over leaking hazardous waste, looked at the air pollution control system, and said, ‘That looks fine,’ and never reported back about the hazardous waste.”²²

For these reasons, some agencies have consolidated the multiple industrial inspections they regularly conduct. Perhaps the best known example of this is the Massachusetts Blackstone Project, a pilot project designed to test a number of pollution prevention initiatives on industries in the Blackstone River Valley and Worcester areas. One objective of the pilot project was to see if one multi-media trained inspector could accomplish the same work as two or more traditional inspectors. Another goal was determining if such a multi-media inspection could identify pollution prevention oppor-

tunities (see box on the Blackstone Project). Commissioner Greenbaum said:

We chose this approach, first, because we were already conducting some 4,000 inspections; second, because we had no common coordination amongst our separate teams of air quality, water pollution, and hazardous waste inspectors; third, because our tightening budget could not allow us the luxury of three or four separate individuals making inspections of the same facility; and finally, because we had strong evidence that our uncoordinated inspections were confusing the regulated community, and ‘pushing pollution around’ among the media rather than reducing it at the source.²³

The Blackstone inspection teams consisted of an inspector from each of the air, hazardous waste, industrial wastewater, and community right-to-know staffs, all working with the pretreatment coordinator from the local wastewater treatment staff. Staff members were cross-trained in all of the programs and developed basic checklists for conducting multiple inspections on the same visit. Three models of inspection were tested: a full-team visit, a two-person visit, and a one-person visit. Inspectors routinely referred companies to a sister agency—the Office of Technical Assistance—for help in identifying source reduction opportunities.²⁴ The results were encouraging, both in terms of increased agency efficiency gains and industries’ use of pollution prevention.

The study found that during twenty-eight inspections conducted in 1989, two

inspectors—and in some cases, one inspector—accomplished as much as the four-person team. In fact, nineteen inspections resulted in notices of non-compliance. In addition, a number of plants, with and without violations, responded to the inspections by instituting pollution prevention. Of the twenty-eight firms visited during 1989, twenty-three implemented toxics use reduction and waste prevention measures by 1991 (most of these firms were aided by the Massachusetts Office of Technical Assistance). In contrast, the Massachusetts Department of Environmental Protection estimates that only

two firms probably would have taken such action in response to the normal, single-medium inspection. Despite the number of violations discovered, most of the companies welcomed having their facility examined comprehensively in a single visit, and at the same time receiving the opportunity to take advantage of coordinated technical assistance.²⁵

Although multi-media inspections can increase efficiency, initially they require additional resources, particularly for training inspectors. The Blackstone Project devoted a large share of its resources to training, and some other

states are following this model. For example, the California Department of Toxic Substances Control aids local governments by offering two-day multi-media pollution prevention training sessions, which provide technical instruction to inspectors throughout the state.

Permit Review

Another approach being tested by a few states is multi-media analysis of permits. Trained staff examine permits and determine whether pollution prevention can be used to achieve compliance without end-of-pipe controls. This approach sometimes is linked with “one-

The Blackstone Project: How Cross-Media Inspections Are Conducted

The first challenge of the Blackstone Project was to develop cross-media inspection teams from existing regulatory staff, who had long operated in relative isolation with little knowledge of other programs. The second challenge was to develop and conduct a cross-media inspection process. Inspectors completed almost a year of extensive instruction using classroom training, case studies, and practice field inspections. The training enabled Blackstone team inspectors to:

- conduct field inspection for minor source categories of air and water pollution, hazardous waste, and Superfund Amendments and Reauthorization Act (SARA) Title III compliance;
- identify source reduction opportunities during multi-media inspections;
- write multi-media inspection reports that included process descriptions, flow diagrams, discharge point descriptions, and violations; and
- recommend enforcement strategies that stressed source reduction and draft enforcement documents for noncompliance with air, water, and hazardous waste regulations.

Once a facility was matched with a particular inspection team (consisting of one to four members), the lead inspector was responsible for coordinating program file reviews, conducting a preparation meeting, leading the actual inspection, conducting a post-inspection conference, and writing the first draft of the inspection report. Each facility inspection consisted of several steps. During the pre-tour conference, the lead inspector introduced the team to the facility personnel, discussed inspection objectives, and asked about plant operations and changes in production that would be observed during the tour. In the facility tour, the inspectors observed production and waste management activity, noting violations and source reduction options. The facility tour often was preceded or accompanied by a document review session, during which inspectors reviewed hazardous waste manifests and contingency plans, and SARA 313 documentation. Inspectors encountering complex issues beyond their area of expertise referred these matters to appropriate program specialists. The inspection was followed by a post-tour conference at which the inspectors and facility staff discussed compliance issues, source reduction opportunities, and the technical assistance program available from the Department of Environmental Management.

stop" permitting, which allows a facility to have all its permits reviewed at once.

New Jersey is one example of a state examining the potential for multi-media permit reviews. New Jersey Department of Environmental Protection and Energy (DEPE) officials recently signed agreements with three industrial companies to examine pollution prevention options and to streamline the way the facilities are regulated. The three participating companies will conduct in-depth inventories and audits of how they use hazardous substances. They will then explore pollution prevention options such as process changes and the use of new, less polluting manufacturing equipment. Also, they will investigate the substitution of non-toxic raw materials for toxic ones.²⁶

According to DEPE Commissioner Scott Wiener, the facilities will be the first in New Jersey to begin complying under a facility-wide permit. Rather than issue separate permits for each discharge into air, water, and land, the facilities will receive a single permit designed to build pollution prevention into the process.

These pilot projects face several challenges. First, permit review staff must receive at least as much training as cross-media inspectors, and coordination among those trained in the individual medium programs is even more critical. Second, the permit writing team must be able to ensure that a pollution reduction technique can comply with all rules for all federal and state programs. States will face difficulty waiving even minor procedural rules in federal programs, even if net, plant-wide pollution reductions are possible. Finally, because

single-medium programs still will be issuing new regulations, facility-wide permits will require coordination to ensure that new standards can be incorporated in a timely manner. Such procedures can present barriers to many of the pollution prevention concepts so seemingly straightforward and sensible.

Fostering Pollution Prevention Through Interstate Cooperation

National and regional organizations of states can enhance the efficiency of their members' pollution prevention programs. First, they can alert members to newly developing programs, research, and technology in other states. They also can pool resources for common activities such as public education and outreach, information clearinghouses, and technical training projects. Finally, they can apply pollution prevention remedies to regional environmental problems that may have common origins. This chapter briefly reviews the experience of several associations with pollution prevention agendas.

National Roundtable Keeps States on Cutting Edge

The National Roundtable of State Pollution Prevention Programs was organized in 1985 as a forum to promote development, implementation, and evaluation of pollution prevention efforts nationwide. The roundtable maintains an up-to-date network of pollution prevention programs and collects information on their work. Today the association has more than 400 members representing every state as well as local governments, universities, public interest groups, and private companies that strive to promote or implement pollution prevention.

The roundtable includes six work groups that focus discussion and produce findings on program effectiveness, data collection, information, training and education, university-based programs, and regulatory integration. The work groups meet and present their reports at the roundtable's two annual conferences. In June 1991, the Program Effectiveness Work Group published a position paper

on evaluation of pollution prevention program components, which represents the general agreement of its membership.

Governors' Endowment Funds Regional Collaboration

In 1988 the Council of Great Lakes Governors created the Great Lakes Protection Fund, the culmination of nearly two decades of increasing cooperation among seven states. The fund enables the Governors of Illinois, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin to jointly address the lakes' ecological problems. They pledged a total of \$100 million to create a permanent funding source for projects that foster regional approaches to toxics use reduction, pollution control and cleanup, research, education, and natural resource stewardship.

A core principle of the fund is that pollution prevention must be the cornerstone of any long-term effort to improve the environment of the Great Lakes basin. While projects in all of the five issue areas adhere to a pollution prevention philosophy, the toxics use reduction projects are aimed at reducing or eliminating toxic emissions from households, farms, and businesses; promoting technologies, including chemical substitution, product reformulation, production process changes, equipment modification, and housekeeping changes; and encouraging consistent basinwide toxics use reduction policies among industry, government, environmentalists, academicians, and citizens.

Presently, the fund endowment is \$56.4 million. Two-thirds of the interest from the endowment goes to regional grants,

with the remaining one-third distributed to member states for local programs.

States Pool Knowledge and Resources to Improve Pollution Prevention Outreach

In 1989 the Northeast Waste Management Officials' Association (NEWMOA) created the Northeast Multi-Media Pollution Prevention Project (NEMPP). NEMPP enables NEWMOA's members to share information, training, and research on pollution prevention activities. The members include state solid and hazardous waste management officials from Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont.

NEMPP was established at a time when the northeast states recognized that rapidly diminishing landfill capacity demanded profound changes in the region's waste generation and management practices. The NEWMOA member states established a waste management hierarchy topped by waste reduction and followed by separation, recycling, and reuse. They also sought reductions in hazardous waste generation. As they pursued their common pollution prevention goal, the member states saw the benefit of sharing their experiences and information.

During the past three years, NEMPP has embarked on a variety of activities. The program offers state officials training on the use of EPA's Pollution Prevention Information Exchange System; conducts pollution prevention workshops with the Massachusetts Office of Technical Assistance and the Tufts University Center for Environmental Management;

and publishes a quarterly newsletter, *Northeast States Pollution Prevention News*, highlighting NEMPP-sponsored projects and events as well as activities in each of the member states. NEMPP also began a clearinghouse of more than 750 books, articles, reports, audit forms, and fact sheets on pollution prevention for use by state officials, industry, and the public.

A work group of pollution prevention technical staff and regulatory officials from air, water, and waste programs in the eight member states provide overall project guidance. Work group members also have the opportunity to share information on their states' programs and to work on cooperative efforts. Through NEMPP, they research policy options that encourage source reduction of toxic metals in municipal solid waste, and comment on federal legislative proposals.

Northeastern Governors Develop Model Legislation

Another regional organization, the Coalition of Northeastern Governors (CONEG), has developed and promoted several pieces of model pollution prevention legislation. CONEG's 1989 Model Toxics Legislation has been enacted in Connecticut, Maine, New Hampshire, New Jersey, New York, Rhode Island, and Vermont, as well as the midwestern states of Iowa, Minnesota, and Wisconsin. The law endorses a regional approach to pollution prevention, stating: "In order to administer packaging waste reduction standards effectively and economically, a regional approach to the reduction of packaging waste is desirable to recognize the multi-state nature of the Northeast economy, to provide for interstate

cooperation in addressing the issue of solid waste management, and to minimize commercial dislocation and maintain a vibrant economy."²⁷

CONEG's packaging reduction bill calls for the reduction of lead, mercury, cadmium, and hexavalent chromium in packaging or packaging materials used or sold in the state. It requires manufacturers and distributors of these products to reduce the sum of the concentrations of lead, cadmium, mercury, and hexavalent chromium to 600 parts per million within two years after the legislation is enacted, and ultimately to 100 parts per million four years after enactment.

The legislation's goal is to reduce the weight of packages or packaging components by 15 percent (from 1988 levels) by 1996, and to study the feasibility of reducing them by 35 percent by 2000. Packagers choose between two reduction strategies: either a company-wide approach to reduce overall packaging by 15 percent by weight, or a specific package approach to ensure that all of their packages are reduced or recycled to certain specifications.

In addition to crafting the packaging bill, CONEG has established the Source Reduction Council, composed of state, public interest, and business representatives. The council developed a set of Preferred Packaging Guidelines in May 1991, which established a hierarchy for package design:

- eliminate the package;
- minimize the amount of material used in the package;

- design packages that are reusable;
- make the package recyclable; and
- incorporate recycled content into the package.

CONEG then issued a challenge to industry to begin implementing the guidelines and report their progress to the CONEG Governors, and more than thirty companies have accepted. CONEG provides the participating firms with a manual covering the logic of source reduction; suggested ways of putting CONEG packaging guidelines into practice; recommended approaches to measuring waste reduction; methods for reducing toxics in packaging; and suggestions for reporting source reduction progress to Governors. Companies that accept the challenge are asked to report their progress annually to the Source Reduction Council in order to document the commitment of government and industry and provide an educational tool to promote consumer awareness.

Regional Pollution Prevention Efforts Protect Natural Resources

A shared natural resource can create another impetus for regional cooperation. The Chesapeake Bay is a prime example of such a resource, providing recreational and economic benefits to all the states that surround it. Moreover, the health and survival of the bay depends on the sound environmental stewardship of the surrounding states.

The states in the region began the Chesapeake Bay Program with strong emphasis on pollution prevention.²⁸

Coordination started in 1980, when the legislatures of Maryland and Virginia established the Chesapeake Bay Commission to coordinate interstate planning and programs from a legislative perspective. (Pennsylvania joined the commission in 1985.) In 1983 the Governors of Maryland, Pennsylvania, and Virginia, the Mayor of the District of Columbia, the chair of the Chesapeake Bay Commission, and the administrator of the U.S. EPA formed the Chesapeake Executive Council and signed the first Chesapeake Bay Agreement. A second, far-reaching agreement was signed in 1987, establishing twenty-nine commitments for action.²⁹ The council directs the Chesapeake Bay Program, with day-to-day supervision provided by an implementation committee composed of twenty-eight representatives of federal and state agencies, regional and legislative commissions, and advisory committees.

The 1987 agreement made pollution prevention a top priority with the stated goal of reducing and controlling point and nonpoint sources of pollution. Specific objectives included evaluating alternative technologies to reduce nonpoint source pollution such as biological nutrient removal and land application of effluent; eliminating pollution discharges from recreational boats; and managing groundwater to protect the water quality of the bay.

The agreement set deadlines for adopting a basinwide strategy to achieve a 40 percent reduction by the year 2000 of nitrogen and phosphorus entering the bay's main stem and another strategy for reducing toxics in the bay. So far 14,000 acres in Maryland, Pennsylvania, and Virginia are covered by nutrient man-

agement plans, which have prevented 1,797 tons of nitrogen and 2,006 tons of phosphorus from reaching the bay. As a result, phosphorus levels in the mid-bay have been reduced by 20 percent from 1984 levels.

The Chesapeake Executive Committee established a Chesapeake Bay Basinwide Toxics Reduction Strategy in 1988 to work toward eliminating discharges of toxic substances to the bay. By 1996, acute and chronic discharges from major municipal and industrial point sources are to be eliminated. The program has nearly completed a basinwide toxics loading inventory to estimate the levels of specific contaminants reaching the bay from both point and nonpoint sources throughout the region. This inventory will enable the program to target resources for program development, especially in pollution prevention activities.

In 1991 the executive council identified pollution prevention as one of four action steps that define the thrust and direction of the Chesapeake Bay Program. The program's current action agenda calls for:

- developing state-specific growth management plans to promote sustainable development;
- encouraging energy efficiency and conservation;
- supporting state nutrient management programs and developing integrated pest management programs to reduce fertilizer use and runoff;

- reducing the discharge of industrial toxics through waste reduction and waste exchange networks;
- preventing oil spills that affect the bay and its tributaries;
- supporting transportation control measures such as carpooling and greater use of mass transit; and
- expanding public education activities.

Jersey, New York, Rhode Island, and Vermont—agreed that beginning in 1989, they would prohibit the sale of gasoline with a Reid Vapor Pressure (RVP) of greater than nine pounds per square inch between May 1 and September 15. A uniform gasoline volatility standard throughout the northeastern states ensures that all the states in the region benefit from cleaner air.

Pollution prevention efforts in the bay already have succeeded in reducing the amount of chemical fertilizer and toxic releases to the bay watershed, improving land use controls for better water quality protection, and increasing the use of integrated pest management.

Northeast States Control Regional Fuel Volatility

Another example of a shared natural resource is air—an environmental medium that knows no state boundaries. In November 1987, the Northeast States for Coordinated Air Use Management signed a memorandum of understanding on controlling gasoline volatility. The agreement arose from concern about violations of the national ambient air quality standard for ozone throughout much of the northeastern United States. These violations result from excessive hydrocarbon emissions caused by high levels of gasoline volatility. One state's efforts to reduce fuel volatility could be easily overwhelmed by neighboring states' failure to act.

The environmental commissioners of the member states—Connecticut, Maine, Massachusetts, New Hampshire, New

Providing Incentives to Prevent Pollution

As industry has sought to lower the cost of production, it has begun to focus more on the cost of pollution. Reducing or eliminating waste streams usually proves less expensive than traditional end-of-pipe controls. A 1992 study by the environmental research group Inform reaffirms this point.³⁰ The study examined source reduction initiatives taken at twenty-seven organic chemical manufacturing plants. They reduced waste by 129 million pounds per year, saving each facility from \$45,000 to \$1 million annually. Therefore, an objective of government pollution prevention initiatives is to promote the economic as well as environmental benefits of waste reduction.

State programs can enhance market signals for pollution reductions by increasing the costs of managing waste through fees and taxes; by rewarding pollution prevention through grants, tax relief, and regulatory waivers; by assisting industry in the design and application of pollution prevention measures; and by providing public recognition for successful industry efforts.

Existing Incentives for Businesses

Even without state government action, strong incentives already exist for companies to pursue pollution prevention. The primary reason for industry is the cost of polluting. EPA estimates that the private sector annually spends roughly \$63 billion (in 1986 dollars) on pollution control, and this may increase to \$89 billion by 2000. When these waste management and environmental compliance costs are acknowledged, they can motivate a company to cut costs through

waste stream reduction or elimination. However, many companies fail to recognize the current costs of controlling pollution from specific product lines or plant processes. A company may track compliance costs for the entire firm rather than for individual product lines or facilities, or it may use an accounting system that buries compliance costs in separate capital and operating budgets. To better understand their compliance expenditures, some firms calculate control costs for each product line and process. In this way, they can more accurately evaluate and compare abatement options, including pollution prevention. While investing in a new process to eliminate a waste stream may raise production input costs, the expense may be more than offset by savings from avoided pollution control expenses. Savings can result from redesigning manufacturing operations to recover and reuse waste, materials substitution to avoid waste, and better housekeeping procedures to produce less waste. With pollution prevention, facilities sometimes achieve a direct return on their investment, in contrast to end-of-pipe controls that typically only add to overall operation and production costs.

State Pollution Prevention Incentives

State incentives attempt to tip the scales toward pollution prevention and encourage industries to create their own waste reducing processes and technologies. Incentives may take the form of:

- financial penalties and fees exacted for waste generation, as well as financial assistance and tax breaks for investing

in pollution prevention research and capital expenditures;

- public outreach and technical assistance to educate industry about the benefits of pollution prevention and to help companies develop pollution prevention plans;
- regulations that require facilities to perform waste audits and develop waste reduction plans or to change product content;
- reporting requirements for waste generators to publicly disclose their facilities' emissions to air, land, and water;
- expedited permitting for source reduction and waste minimization projects, and permit conditions requiring pollution prevention measures; and
- enforcement settlements for violations of environmental regulations that incorporate pollution prevention planning and implementation requirements (see Chapter 3).

Economic Incentives Enhance Economic Appeal of Reducing Waste
Economic incentives for adopting pollution prevention measures include penalties for waste generation such as pollution discharge fees, and monetary benefits such as grants, low-interest loans, and tax relief.

Fees. Fees are the most popular economic tool among the states because they serve the dual purpose of discouraging pollution and providing revenue for state programs. Over the last decade, states have increasingly relied on fees to offset

declining federal support for environmental programs and to lessen the demand on state general revenues. A 1989 National Governors' Association survey of all states found that approximately \$100 million in fees and taxes were being collected to help fund environmental programs. It is likely that this sum has jumped considerably over the last few years, and new requirements under the 1990 Clean Air Act Amendments—which mandate state emission fee programs—will soon cause a further increase.

“Front-end” fees (or feedstock taxes) usually are imposed on production materials that are transformed into pollutants through manufacturing. Ideally these fees are levied on the toxic materials that are considered most hazardous. They are intended to discourage their use or at least help pay for some of the costs of regulating them. The Superfund tax on oil and chemical feedstocks is perhaps the best known front-end tax, but states also have been instituting their own front-end fees. For example, the Colorado Pollution Prevention Act of 1992 will impose chemical inventory fees on certain hazardous waste generators in the state.³¹ Facilities required to report under Section 312 of the Superfund Amendments and Reauthorization Act (SARA) will be charged \$10 for every hazardous substance on site that exceeds the U.S. EPA's threshold planning quantity, and facilities reporting under SARA Section 313 will pay \$25 for each extremely hazardous substance on site in excess of the federal threshold. Thus, the fees could provide an incentive to reduce the number and quantities of listed hazardous substances at the facil-

ities. In addition, the fees will be allocated to the Colorado Pollution Prevention Advisory Board for use in pollution prevention programs and grants.

By contrast, “waste-end” fees are assessed on the generation or discharge of wastes. For example, Iowa, Louisiana, New Hampshire, and West Virginia assess fees on generators of hazardous or solid waste based on quantities generated. In California, facilities that annually emit 500 tons or more of sulfur or nitrogen oxides to the air are assessed an acid deposition fee of \$5 per ton of emissions.³²

Fees and taxes may not always be an effective incentive for pollution prevention. In many cases, fees cannot be established at levels that would significantly cut pollution, and there is no guarantee that a generator will not respond to a fee by simply transferring emissions from one environmental medium to another. In fact, fees are a truly effective pollution prevention instrument only when they are assessed on pollution released to all media and balanced in a manner that seeks reductions at the point of greatest risk. However, fees can be used to raise funds for a potentially more powerful incentive—grants.

Grants. Grants usually take the form of direct payments from the state to waste generators or others engaged in pollution prevention activities. The grant programs in at least thirteen states typically provide matching funds to businesses for reducing pollution beyond normal environmental standards or through innovative methods.

North Carolina offers a matching grant program that provides funds of up to \$15,000 for the cost of personnel, materials, or consultants needed to undertake pollution prevention projects. Projects eligible for grant funds include those that characterize waste streams to identify pollution reduction opportunities and those that conduct in-plant and pilot scale studies of reduction technologies. Each project must address waste reduction specifically and be technically and economically transferable to other North Carolina businesses. The size of the incentive can vary at the state's discretion, based on the evolving priorities of the pollution prevention program.³³

The California Department of Toxic Substances Control provides grants for research and development of hazardous waste reduction, recycling, or treatment technologies. Established by state law in 1985, the grant program has funded more than 120 projects. Annual program funding has been as high as \$1.8 million, but in fiscal 1990 funding was reduced to less than \$1 million due to budget constraints. The department also awarded one county a grant to develop a small business pilot program in hazardous waste management. The county must set up educational and waste reduction programs for targeted small-quantity hazardous waste generators and design a pilot collection system for wastes that the generators are unable to reduce. The county has committed to continuing this program after the grant funds expire.³⁴

Apart from finding a funding source within limited state budgets, there appears to be no major barrier to implementing a grant program. The greatest obstacle to operating a matching

grant program is identifying businesses willing or able to contribute their share of funding. Businesses also must be willing to develop technology that later may be used by competitors.

Loans. Low-interest loans for pollution prevention projects usually are offered to small businesses at below-market rates to provide the capital for investments in the equipment needed to reduce or eliminate waste. The California Department of Commerce offers low-interest loans in amounts ranging from \$20,000 to \$150,000 to assist small businesses in pollution prevention.³⁵

In Missouri the Environmental Improvement and Energy Resources Authority, an independent, nonregulatory state agency, provides low-cost or no-cost financing for projects to reduce, control, or prevent pollution, and encourages research and development of energy alternatives. Projects are financed through industrial revenue bonds (with tax-exempt interest) and low-interest loans. Since 1973, the authority has issued tax-exempt bonds, notes, and commercial paper in excess of \$1.8 billion.³⁶

Under a memorandum of understanding between Delaware's Development Office and Department of Natural Resources and Environmental Control, the state has created the Green Industries Initiative to promote the reduction of waste generation and use of recycled materials. The program rewards companies that have demonstrated success in pollution prevention by providing special tax incentives, financing assistance, and technical assistance.³⁷

Technical Assistance and Outreach Show the Way

Many state pollution prevention programs directly assist industry in developing pollution prevention projects. Most involve one or more of the following:

- outreach activities to educate, publicize, and promote pollution prevention with seminars, pamphlets, conferences, and awards;
- technical assistance, including waste audits, seminars, process design consultation, and information clearing-houses; and
- research and development efforts, which develop new pollution prevention techniques and industrial processes.

Outreach Activities. Thirty states conduct some sort of pollution prevention outreach through educational activities, conferences, and award programs. For example, the Delaware Department of Natural Resources and Environmental Control (DNREC) held a recycling and waste minimization seminar for sixty attendees in March 1991, and gave about thirty talks and lectures to business, school, civic, and government groups throughout the year. DNREC also is publishing a *Waste Reduction Self-Evaluation Manual* to assist small and medium-sized businesses in implementing waste reduction programs and pollution prevention guides targeted to printers, auto repair shops, general businesses, and dry cleaners. In addition, in cooperation with the Delaware Chamber of Commerce, DNREC published a special pollution prevention pull-out section for the *Chamber News*, which

was distributed to 14,000 subscribers in December 1991.³⁸

In another cooperative effort with the chamber, DNREC is sponsoring quarterly meetings of the Pollution Prevention Industry Roundtable, which are open to all Delaware businesses. The meetings provide a forum in which companies learn from one another and share their experiences in adopting pollution prevention and recycling strategies. The roundtable also gives the department an opportunity to educate business leaders about pollution prevention.

The Tennessee Department of Environment and Conservation funds the Waste Reduction Assistance and Technology Transfer program at the University of Tennessee. The program performs on-site waste reduction assessments, provides information on waste reduction technologies, and offers technical assistance and training for Tennessee industry. In addition, the program produces national teleconferences, such as "Solvents: The Good, the Bad, and the Banned," which was directed at plant owners and managers, waste management personnel, state environmental regulators, and waste reduction technicians. This March 1991 teleconference featured experts and case studies on how to identify and evaluate short- and long-term options for solvent waste reduction.³⁹

Direct Technical Assistance. Direct assistance can be the critical force moving business—especially small firms—to pollution prevention. States can provide this assistance through clearinghouses, seminars, and workshops. However, the most ambitious form is

on-site assistance, in which the state sends staff engineers—knowledgeable about the industrial process—to the plant. The staff examine the production line and offer advice on pollution reduction opportunities. In some instances, the staff help the company conduct an analysis of the potential costs and savings associated with different pollution prevention options.

At least twenty-eight states provide some form of on-site technical assistance to industry. Most of the technical assistance staff reside within the solid or hazardous waste departments, with a few established as separate agencies.⁴⁰ A typical example is the North Carolina Pollution Prevention Program's (NCPPP) technical assistance for multi-media industrial waste reduction. Working in cooperation with the Solid Waste Management Division and the Governor's Waste Management Board, the nonregulatory NCPPP addresses water and air quality, toxic materials, and solid and hazardous waste.

NCPPP's five technical staff perform customized computer literature searches of the waste reduction information clearinghouse; prepare facility or waste stream-specific waste reduction reports for industries and communities; offer on-site technical assistance through facility visits; and give presentations on pollution prevention to industry, trade associations, professional organizations, and citizen groups. In fiscal 1992, the program provided technical assistance 650 times, including eighty on-site visits—a volume that is projected to double in fiscal 1993.

Similarly, the New Jersey Technical Assistance Program provides free, confidential information and technical

assistance to all industries in the state. Services include literature searches on technical and economic information (including case studies), a hotline, mailings, and on-site reviews, audits, and advice. Site visits have been conducted at auto repair shops, chemical manufacturing and research and development facilities, electric utilities, metal use and manufacturing plants, petroleum processing plants, and other industrial facilities.

The California Department of Toxic Substances Control combines on-site technical assistance with publication development. Under a waste audit program, the department selects three to six companies within each targeted industry and conducts waste minimization audits at their facilities. The information from the audits is then used to develop a "self-audit" form for distribution to other companies in the industry. The audit reports list the waste streams typically generated by the industry and discuss general waste minimization options for various industry processes that generate hazardous waste. Audit reports have been completed for more than twenty industries, including pesticide formulators, metal finishers, circuit board manufacturers, automotive repair and paint shops, building construction and trades, and commercial printers.⁴¹

Finally, a less labor-intensive approach to assistance is the clearinghouse. Clearinghouses provide a database of professional contacts, literature citations, case study summaries, and other information. Data sources include universities, trade associations, research laboratories, and government agencies. Some clearinghouses are administered by colleges or

universities, while others are run by state agencies. The Delaware Development Office provides businesses with access to a computer database of successful waste minimization efforts throughout the United States as well as in other countries. The clearinghouse contains examples of waste reduction techniques and a bibliography of waste reduction reference materials. The information is sorted by standard industrial classification codes.

Research and Development Generate Ideas

Research and development projects usually involve funding an industry, university, or other outside research institution to develop pollution prevention techniques and processes that are transferable to state industries. Minnesota provides matching grants of up to \$30,000 to help small and medium-sized companies study or demonstrate the feasibility of applying specific techniques and methods to pollution prevention. Common research and development projects include feasibility studies, pilot and bench-scale demonstration projects, and economic and policy analyses.⁴²

The California Department of Toxic Substances Control runs a research, development, and demonstration program with two objectives: to demonstrate hazardous waste treatment technologies that provide an alternative to land disposal, and to promote waste minimization, recycling, and treatment technologies. The program focuses on demonstrations that lead to commercialization of viable technologies. The department actively participates in demonstrating the technologies; performs engineering evaluations of innovative

technologies; assists its regional offices in selecting alternative treatments for site cleanups; and provides technical and permit assistance for research, development, and demonstration projects.

Regulatory Requirements Prompt Planning

States can use regulations to encourage industry to develop pollution prevention programs. These may take the form of prescriptive rules that ban certain industrial practices, impose facility design and operational standards, and require agency approval prior to the disposal of a particular waste stream. For example, Maine has banned aseptic packaging because it cannot be removed or reduced in the waste stream.

Another example is legislation enacted in New Jersey in January 1992 that directs manufacturers to reduce the mercury content in batteries sold in the state. The law was designed to reduce the presence of mercury in incinerator emissions or residual ash, and to require the dry cell battery industry to bear a more equitable share of the environmental costs of battery disposal. The Dry Cell Battery Management Act will prohibit the sale of all alkaline manganese batteries manufactured after January 1996 that exceed a threshold of 0.0001 percent (one part per million by weight) for mercury content. The same standard applies to zinc-carbon batteries manufactured after January 1992.⁴³

Notwithstanding the New Jersey law and other specific source reduction requirements, usually states eschew a prescriptive regulatory approach because pollution prevention is most effective when experts in the industry, who have the most

knowledge of its processes and the pollution generated, design their own strategies for reducing waste. Moreover, prescriptive rules such as bans sometimes do not prevent an alternative form of pollution from being released. For these reasons, many state regulations require companies to develop their own pollution prevention strategies. The regulations not only utilize industry expertise, but also relieve the state of responsibility for enforcing mandatory requirements.

The California Hazardous Waste Source Reduction and Management Review Act of 1989 established several approaches for encouraging source reduction among the state's generators of the largest quantities of hazardous waste. Under the law, generators of more than 13.2 tons of hazardous waste or more than .01 ton of extremely hazardous waste per year must prepare a source reduction evaluation review plan every four years. The plan identifies all major hazardous waste streams and evaluates each stream for all viable approaches to source reduction. Generators also must prepare a hazardous waste management performance report, which assesses the effectiveness of the generator's hazardous waste management procedures.⁴⁴

In addition, beginning in September 1991 and every two years thereafter, the California Department of Toxic Substances Control is selecting at least two generator categories for review to ensure that their plans and reports have been properly prepared, and to determine whether the generators have implemented the source reduction measures that were identified in their plans.

Finally, the law requires the department to expand its technical assistance and research program to assist generators in examining source reduction options; establish a database to track categories of generators and the source reduction and waste management practices identified in their plans and reports; take enforcement action to ensure compliance with the law; provide full protection of information deemed by the generators as trade secrets; and offer special assistance to small businesses that must comply with the law.

Thus, while the law does not expressly require implementation of source reduction measures, large-quantity generators must take the first and most important step—identifying pollution prevention opportunities and methods—toward instituting source reduction. At the same time, the state offers information and technical assistance to help these generators develop and carry out their plans.

Under its Hazardous Waste Reduction Act, Texas requires facilities to develop pollution prevention plans similar to those in California. Beginning in July 1993, hazardous waste generators and persons reporting releases to the Toxics Release Inventory must prepare five-year source reduction and waste minimization plans that detail reduction goals and specify projects to achieve them. The plan must identify the activities that generate hazardous waste or that result in the release of pollutants; include a list of feasible source reduction and waste minimization projects; explain the selected projects; and estimate the quantities and types of anticipated reductions following project implementation.⁴⁵

Each covered facility must submit an executive summary of the plan to the Texas Water Commission and Air Quality Control Board by the implementation date, and annually thereafter provide a report on the facility's progress in implementing the plan. Annual quantities of hazardous waste generated or toxic substances released must be compared with these quantities for 1987.

Disclosure Requirements Reveal Wasteful Ways

Many states have adopted regulations requiring generators to report on their waste streams and emissions. These reports can be used to monitor the firms' releases to all media and the progress being made in pollution prevention. Many of these reports are open for public review, and public reaction alone often is enough to motivate industry to reduce its waste. The Toxics Release Inventory (TRI), which is part of the federal Emergency Planning and Community Right-to-Know Act, is the most widely known example of emissions data that is collected under a disclosure rule.

When in 1988 the TRI showed Louisiana led the nation in levels of emissions reported, the Louisiana Department of Environmental Quality (DEQ) put this distinction to work. DEQ contacted the state's twelve top emitters to air, land, and water—thirty-two companies in all since some topped the list in more than one medium—to request voluntary pollution prevention plans. The emissions from these companies accounted for 80 to 90 percent of the state's total volume. Since the names of the worst polluters were well-publicized, the companies were eager to cooperate in adopting plans.

DEQ reviewed the submitted waste reduction plans and published the results in a report, *Corporate Response to the DEQ's Request for Toxic Waste Reduction Plans, 1990*. Implementation of the plans helped reduce Louisiana's total releases and transfers by 292.7 million pounds in 1989—a decrease of 38 percent.⁴⁶

In Delaware the Department of Natural Resources and Environmental Control used the TRI data to identify the top twenty polluters in the state. Each of the twenty companies, ranging in size from large corporations to one-shop firms, was invited to participate in a voluntary reduction program. When asked in a well-publicized letter to commit to reducing their toxic releases by 50 percent by 1995, eighteen of the twenty companies agreed. Pollution prevention staff from the department now are working with the firms to achieve their goals.⁴⁷

Permit Process Can Change Behavior

States can use procedural requirements, such as permit review, to encourage the use of pollution prevention. For example, Delaware offers expedited permitting for industries that have adopted pollution prevention measures. The program assigns priority status to the air, water, and hazardous waste permits of a firm using pollution prevention. Texas provides for expedited review of a permit amendment application in cases where an amendment is necessary to implement a source reduction or waste minimization project. The review considers only the parts of the permit directly affected by the project.

The permit process also may be used to remove regulatory barriers to adopting pollution prevention strategies. Under the Massachusetts Toxics Use Reduction Act, the Department of Environmental Protection may temporarily waive a permit requirement to enable a firm to institute a toxics use reduction method, provided the benefit of the proposed toxics use reduction is greater than any environmental risk of waiving the permit requirement. To date, this authority has been used once, when the department waived a requirement that a facility obtain an industrial wastewater plan approval prior to construction of a pretreatment system. The waiver enabled the firm to use a new production process that eliminated the use of three toxic chemicals and included an integral recycling system to reduce the use of a fourth chemical.⁴⁸

The Texas Air Control Board has incorporated pollution prevention into its permit review process under the authority of the Texas Clean Air Act. The act requires permit applicants to include a best available control technology (BACT) for emissions from new or modified sources. The Texas Air Control Board staff have used the BACT review to identify process alternatives that reduce or eliminate air emissions. "Clean process options" have been identified for fifteen processes and are routinely incorporated in air permits for these sources in order to meet their BACT requirements.⁴⁹

Identifying Barriers to Pollution Prevention

Agencies within state government and the businesses they regulate encounter a variety of barriers to pollution prevention. These disincentives can be economic, regulatory, or institutional in nature, and can affect both the state's ability to promote pollution prevention and the regulated communities' ability to adopt changes to reduce waste.

Economic barriers may involve the simple lack of financial resources to invest in pollution prevention techniques or initiate new pollution prevention programs, despite their ability to lower costs over time. Barriers also lie in accounting methods that fail to present the overall or long-term savings created by pollution prevention efforts. Regulatory disincentives include inflexible rules, provisions that specify particular control technologies, and control requirements that do not "credit" reductions achieved through process change. Institutional barriers are present in the infrastructure and attitudes of both government and business, which are slow to adopt new ideas and practices.

Economic Barriers

Pollution prevention can yield economic benefits. States can save money through more efficient inspection and permitting techniques used in some pollution prevention programs. Savings also result from reduced demand for state environment officials to monitor and enforce pollution discharges when facilities eliminate regulated waste streams. Businesses can realize savings through lower compliance costs, avoided liability expenses, and often, enhanced productivity through more efficient manufacturing. Yet, ironically, economic barriers also can discourage pollution prevention efforts.

For state agencies operating under myriad legal mandates, existing demands on staff and resources can preclude efforts to develop pollution prevention initiatives. Today, resources in most states are strained, and pollution prevention projects—even when they save money over the long term—must compete for the few dollars available. And in many cases, agencies cannot afford to shift existing staff into new pollution prevention programs.⁵⁰

Industry faces similar obstacles, but perhaps on a more significant scale. One problem can be traced to accounting methodologies that fail to assign an environmental cost to each product line or process. Such failure can obscure the compliance costs of individual processes, making it difficult to compare these costs with those of pollution prevention. The other problem lies with how companies treat capital projects for pollution prevention versus those for pollution control. Marlene Wittman of the Massachusetts Office of Technical Assistance explains:

In many cases, the companies set lower hurdle rates or eased the pay-back requirements on capital expenditures for pollution control projects because of the compliance issue. However, given the fact that pollution prevention involves the installation of equipment or a process change in order to eliminate the use of toxics, as an alternative to end-of-pipe solutions, the compliance rationale cannot be used in the corporate approval process. Therefore, when environmental personnel seek approval for capital expenditures for pollution prevention equipment, they cannot claim that the expenditure is necessary to keep the facility

in compliance; they have to justify the project's importance and performance just like every other department competing for capital within the company.⁵¹

Regulatory Barriers

Some barriers to pollution prevention are the product of inflexible regulations that emphasize control, treatment, or disposal of pollutants through prescribed techniques. These regulations can inhibit innovation within regulatory agencies and among the regulated community.

Some of the regulatory concepts established twenty years ago for environmental protection conflict with current ideas about pollution prevention. A primary example is the use of design standards in place of so-called performance standards. Design standards specify a particular approach, and sometimes a type of equipment, for controlling pollution. These standards do not accommodate emerging technologies that can better control pollution or eliminate it altogether. In contrast to design standards, performance standards emphasize the goal being sought, allowing various methods to achieve the same goal and preserving opportunities to reduce or eliminate waste.

Another concept that may inhibit pollution prevention is "technology forcing." Technology forcing standards require regulators to search continually for more restrictive controls on sources seeking permits. For example, "best available control technology" (BACT) is defined in the Clean Air Act as "an emission limitation based on the maximum degree of reduction . . . which the permitting

authority, on a case-by-case basis, taking into account energy, environmental and other costs, determines is achievable."

Although increasingly ambitious emission reductions are desirable, BACT emphasizes reductions through pollution controls rather than process change, better housekeeping practices, or other pollution prevention measures. In fact, industry often has contended that when it institutes a pollution reduction measure—such as changing product input to lower emissions—a BACT review still can occur, requiring additional reductions on the little waste that remains. Such regulatory mindsets can diminish the economic incentives for pursuing pollution prevention, since control equipment must be purchased in addition to the pollution reduction measure taken.

In addition, the dominance of single-medium environmental laws and programs continues to hinder some pollution prevention approaches. For example, usually it is not possible for industry to work with all the regulatory programs at once to establish a set of standards for an entire facility. Such coordination would allow companies to plan large-scale process changes to reduce pollution. Instead, industry still must contend with many "moving targets," meeting the regulations of each media program on a sporadic basis. Moreover, some plant managers resist tinkering with their manufacturing processes—even to lower pollution—for fear that it may trigger a major review of all permits and lead to more stringent standards. As a practical matter, it will be some time before laws expressly devoted to cleaning up the air, water, or land will be replaced by laws calling for total reductions across all media—and granting permission to

trade pollution reduction credits between each one.

Unfortunately, it is hard to strike the correct balance between regulatory flexibility and ambitious environmental standards, but this flexibility will be the key to many pollution prevention initiatives. A fresh look will be needed on how environmental regulations treat process changes, and new authority may be needed to allow regulators to waive certain requirements to accommodate actions that reduce pollution. For pollution prevention to work on a large scale, greater trust must be given to negotiating compliance options that meet the spirit—if not the letter—of the law.

Finally, government must see that efforts to create regulatory incentives for pollution prevention do not in fact discourage it. For example, there has been confusion about the impact of voluntary emissions reductions under U.S. EPA's "33-50" program and the call for emissions reductions of 90 percent under the federal Clean Air Act Amendments. Some industry representatives have expressed concern that the voluntary reductions they already have achieved will force them to make greater reductions under the new law than are required of their counterparts who never reduced at all.

Institutional and Educational Barriers

Rules, behavior patterns, prescribed practices, and adherence to established procedures all present institutional barriers. Both government and the private sector exhibit reluctance to tamper with proven processes for fear of adverse effects.

The major barriers facing state agencies result from the “business-as-usual” syndrome. Laws establishing each environmental program contribute to this problem. Each of these laws has spawned dedicated federal and state personnel working to achieve the goals of their particular media program, be it air, water, or waste control. Little motivation exists for cooperation between departments; indeed, employees may be discouraged from lending time to efforts outside their own mission.

Lack of training also hinders regulatory efforts to promote pollution prevention. Most successful programs involve some form of technical assistance and multimedia expertise. Both require training and education for staff. Today most of this training must be done by state regulatory agencies; generally neither public education systems nor colleges and universities offer pollution prevention curricula.

For business, institutional barriers are similar—companies adhere to familiar practices, staff in different departments may not cooperate, and pollution prevention training and education opportunities are limited. Industry may resist prevention options that require operational changes, equipment alterations, or process modifications because of potential adverse effects on product quality. In some cases, rigid product specifications prevent consideration of any manufacturing change. Some changes also may produce fears of job loss, particularly if they eliminate a waste stream that requires labor. Although experience shows that companies with pollution prevention programs can produce higher

quality products in a more efficient manner without threatening jobs, these fears cannot be completely discounted.

Certain institutional structures in business also may inhibit development of pollution prevention initiatives. For example, environmental managers may not have direct influence over production areas, or middle and top-level managers who devise a pollution prevention plan may not involve or communicate effectively with the employees directly responsible for implementing it.

Making Pollution Prevention Work

Policymakers, academicians, government regulators, and business managers who have seriously examined pollution prevention invariably describe it as a “win-win” proposition. Its benefits are well-known and include:

- **Improved environmental protection.**

Pollution control cannot protect the environment as well as prevention. First, standards that allow a “safe” level of emissions are less protective than are no emissions at all. Second, pollution control equipment and methods can fall out of compliance, whether by design or accident. And finally, controls always run the risk of shifting pollution from one environmental medium to another. Pollution prevention by definition provides the highest degree of environmental protection.

- **Preservation of natural resources.**

Waste represents the squandering of raw materials. Every pollution prevention method that reduces waste at the source preserves raw materials, either by eliminating them from a process or by seeing that the process puts them to use.

- **Reduced regulatory burden.** While pollution prevention does not allow government to abdicate a regulatory role, elimination of a waste can lessen the need for monitoring, inspection, enforcement, and oversight. This frees both government and industry to devote more resources to productive work.

- **Lower costs.** Pollution prevention programs can cut costs. When waste is reduced, so is the cost of controlling it. Less money is devoted to nonproductive activities, leaving more money for improving production.

Because pollution prevention can yield benefits for government, business, and the environment alike, pollution prevention programs can be built on cooperation. They can eliminate traditional conflicts between “regulators” and “polluters,” and instead foster a spirit of volunteerism and creativity. This means government’s best role in promoting pollution prevention is to help industry recognize its benefits, identify the methods of achieving it, and invest the time and resources in aiding business—and government itself—in implementing source reduction programs. Government also must seek opportunities for rewarding pollution prevention, whether through public recognition of successful efforts, expedited permitting for facilities that adopt pollution prevention plans, or economic benefits such as tax breaks and grants.

While these tasks present a challenge, most states are meeting that challenge by following several basic tenets.

Establish and Maintain High-Level Pollution Prevention Support

Although pollution prevention in most cases complements regulatory programs, most state agencies are unable to undertake new activities without clear direction from the top. Many successful state pollution prevention efforts are initiated at the highest levels—through the Governor’s office, the legislature, the agency head, or combinations among the three.

A pollution prevention mandate is needed for several reasons. First, budgets simply are too strained, mandates too overwhelming, and departmental balkanization too pervasive to accommodate new

programs without some higher direction. Agencies may lack authority to divert limited state dollars and staff from existing programs to support the pollution prevention initiative.

Second, top-level leadership can draw the entire state government into pollution prevention efforts and ensure that state agencies cooperate. It imbues every agency with a common mission and sees that agencies do not work at cross-purposes in achieving their pollution prevention goals. For example, Ohio Governor George V. Voinovich showed the value of his involvement when he drew the entire state government into his Pollution Prevention Development Work Group.

In addition, this leadership gives pollution prevention activities a high profile among the public and the business community and helps enlist their support. For example, Delaware Governor Michael N. Castle announced creation of the Green Industries Initiative, which rewards companies that have pollution prevention programs. His public endorsement elevated the program and heightened awareness of the public-private cooperation.

Finally, a mandate creates the administrative structure needed for implementing a pollution prevention program. Most programs require interdepartmental cooperation and may call for interagency coordination. A formal structure assigns responsibility for identifying waste reduction opportunities (throughout both government and industry), setting up technical and financial assistance programs, and reporting on pollution prevention progress.

Create a Multi-Media Focus

Pollution prevention requires a shift in focus from single-medium pollution control to multi-media pollution reduction. Government must work at making this shift successful, both for industry and state agencies. It must overcome regulatory and institutional barriers and change the way it has conducted business for decades.

To start the process, environmental program offices that have traditionally been responsible for one environmental medium must begin working together. As the Massachusetts Blackstone Project has shown, multi-media compliance inspections can begin fostering such cooperation. Blackstone inspection teams put the expertise of every program office to work and identify opportunities to prevent pollution and eliminate emissions to all environmental media. In New Jersey, a ground-breaking permitting approach that consolidates all single-medium permits into one also promotes interdepartmental cooperation. The environment department's separate program offices must work together to establish permit standards and to incorporate a multi-media pollution prevention plan into the permit as well. These efforts help both regulators and industries integrate their pollution prevention activities and ensure that net source reduction occurs.

Accommodate and Reward Private Sector Pollution Prevention Initiatives

State governments must be willing to change the way they do business to facilitate pollution prevention, whether through regulatory flexibility, improved

and expedited permitting, or negotiation of consent decrees that incorporate pollution prevention. For example, permits issued under existing pollution control programs can be used to encourage pollution prevention. In Delaware companies that have adopted pollution prevention measures receive expedited permitting—a valuable incentive. Pollution prevention also can be worked into the permits themselves. In Texas the Air Control Board incorporates options for reducing or eliminating emissions into the state's Clean Air Act permits. And in California and New York, enforcement actions have reduced penalties for violations in exchange for companies undertaking pollution prevention efforts.

States also should consider rewarding pollution prevention efforts through tax breaks, grants, and loans that spur businesses to make capital and personnel investments that pay for themselves in savings over time. For example, by linking tax relief to waste generation through an "environmental scorecard," Louisiana was able to induce large industrial facilities to devise pollution prevention plans. In North Carolina matching grants help businesses finance pollution prevention projects, and in California low-interest loans enable small businesses to invest in pollution prevention equipment. These programs eliminate some of the financial obstacles to introducing new technologies and methods.

Provide Technical Assistance

State technical assistance, outreach, and clearinghouse services can create the impetus for industry to undertake pollution prevention projects. They can alert

businesses to pollution prevention opportunities they may have overlooked and educate them about emerging source reduction technologies and methods. Many of these programs already are well-developed and varied, with more innovative approaches continually introduced. For example, North Carolina's program provides technical assistance to hundreds of companies and expects to make 150 site visits in 1993. In an unusual combination of on-site assistance and information dissemination, California has used waste audits of three to six companies in targeted industries to write self-audit forms and audit reports for twenty industries.

Beyond offering on-site technical assistance, states can foster awareness of pollution prevention by integrating it into various academic disciplines such as chemical engineering. Pollution prevention should be a component of courses on unit operations, process control, separations, and process design, rather than a separate area of study. States also can encourage small and large businesses to exchange pollution prevention information.

Forge Public-Private Cooperation

State governments should not pave the way toward pollution prevention alone. Prevention efforts will be most successful if they involve business leaders, environmental groups, and the public at large in developing strategies. These groups bring specialized knowledge to the process, lending insights about pollution prevention incentives and barriers, and can help shape the goals of the state. In addition, as contributors to the state policy or program, these groups will

embrace the pollution prevention effort. Industry skeptics leery of another regulatory hurdle will understand the economic benefits of the program, while environmentalists concerned about undermining regulatory controls will see the program's role in furthering environmental goals.

A number of states have used this approach and included business, the public, and citizen groups in developing their pollution prevention strategies. For example, the Texas Water Commission established an advisory panel on hazardous waste management, which includes members from the Sierra Club, DuPont, the League of Women Voters, and the Houston Chamber of Commerce. Its mission is to assist the commission with developing and implementing hazardous waste policies, with an emphasis on pollution prevention. Its first priority was helping to develop a comprehensive multi-media pollution prevention program. In Delaware a similar advisory group called the Waste Minimization-Pollution Prevention Committee, which includes the Delaware Chamber of Commerce and public interest groups, plays an ongoing role in the state's pollution prevention program.

Participate in Interstate Organizations

State governments are the pioneers of pollution prevention and have a wealth of information and experience to share. Increasingly, interstate associations—whether or not they are dedicated exclusively to pollution prevention—are providing a forum for pollution prevention education, discussion, and even policy

development. Regional organizations in particular can be instrumental in shaping state policies by forging interstate agreements and recommending actions to prevent regional pollution problems.

Collect Reliable Quantitative and Qualitative Pollution Prevention Data

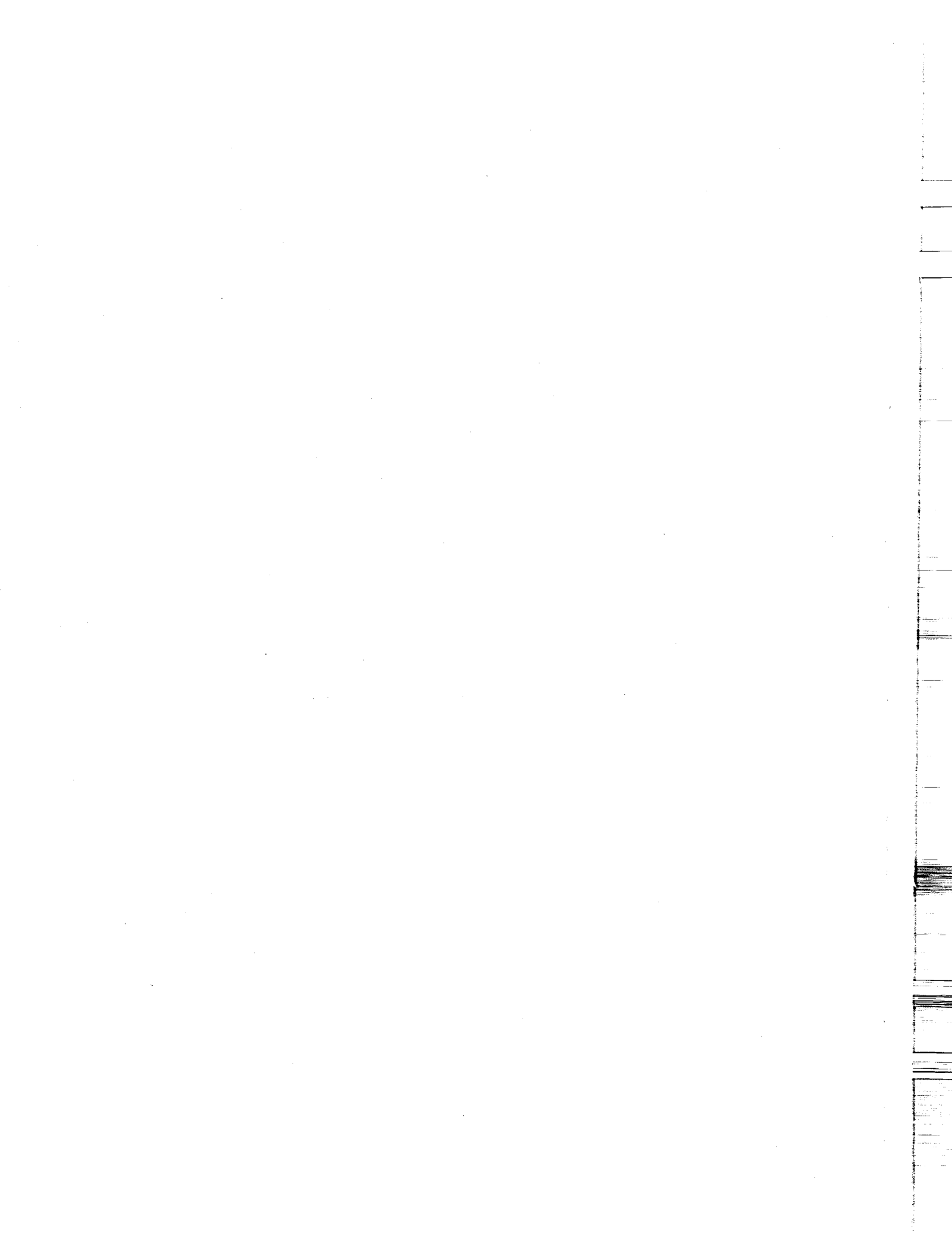
Quantitative and qualitative data are essential to winning and sustaining support for pollution prevention efforts and measuring their progress. Some of these data already are collected through reporting under regulatory programs and the federal Toxics Release Inventory, but they do not provide a comprehensive assessment of pollution reduction. According to the National Roundtable of State Pollution Prevention Programs, existing waste generation and release data do not correct for variables in waste generation and release rates such as fluctuations in production levels; treatment techniques that reduce amounts of waste reported but leave generation rates unchanged; shifts of releases among different environmental media; and material substitutions that generate new types of waste or releases that are unregulated or regulated differently.⁵²

To improve data utility, existing databases should be integrated to present a multi-media view of each industrial facility. Massachusetts is a pioneer in this effort, integrating the state's twenty-eight environmental databases to shed light on pollution prevention progress as well as regulatory compliance. In addition, federal and state regulators should develop a systematic approach for measuring waste reduction at the plant level, including measures for individual pro-

cesses and product lines. Some states already are addressing the data issue. The Texas Water Commission is considering taking a step in that direction by expanding and improving TRI data collection to enhance its pollution prevention applications.

Conclusion

The 1990s have ushered in countless pollution prevention initiatives in both the public and private sectors. Most states are committed to prevention for achieving more efficient environmental policy, and businesses are rapidly buying in to the pollution prevention ethic. Through the tools described in this report and innovations underway, pollution prevention ultimately can become an underlying philosophy of every state activity.



Endnotes

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25. Greenbaum, op. cit.

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Chapter 6

50. Because general revenues are so strained, many states have begun pollution prevention and waste minimization programs using alternative revenue sources such as fees, taxes, and fines. A common revenue source is waste generation and disposal fees. The only drawback of this approach is that the resulting pollution prevention program sometimes must be dedicated to the particular environmental medium from which the fees are raised (e.g., a waste disposal fee must support a waste minimization program).

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Appendix B—Definitions of Pollution Prevention

Pollution Prevention Act of 1990 (42USC13120)

The term “source reduction” means any practice which—

- i. reduces the amount of any hazardous substance, pollutant, or contaminant entering any waste stream or otherwise released into the environment (including fugitive emissions) prior to recycling, treatment, or disposal; and
- ii. reduces the hazards to public health and the environment associated with the release of such substances, pollutants, or contaminants.

The term includes equipment or technology modifications, process or procedure modifications, reformulation or redesign of products, substitution of raw materials, and improvements in housekeeping, maintenance, training, or inventory control.

The term “source reduction” does not include any practice which alters the physical, chemical, or biological characteristics or the volume of a hazardous substance, pollutant, or contaminant through a process or activity which itself is not integral to and necessary for the production of a product or the providing of a service.

Colorado Pollution Prevention Act of 1992

“Pollution prevention” means any practice which reduces the use of any hazardous substance or amount of any pollutant or contaminant prior to recycling, treatment, or disposal, and reduces the hazards to public health and the environment associated with the use or release or both of such substances, pollutants, or contaminants.

Massachusetts Toxics Use Reduction Act of 1989

Toxics use reduction means in-plant changes in production, processes, or raw materials that reduce, avoid, or eliminate the use of toxic or hazardous substances or generation of hazardous by-products per unit of production so as to reduce overall risks to the health of workers, consumers, or the environment without shifting risks between workers, consumers, or parts of the environment.

Minnesota Toxic Pollution Prevention Act of 1990

[Pollution prevention means] eliminating or reducing at the source the use, generation, or release of toxic pollutants, hazardous substances, and hazardous wastes.

***Appendix C—Environmental Laws
Passed, Amended, and/or Reauthorized by Congress, 1970–1989***

Law	Date	Implementation
National Environmental Policy Act (NEPA)	1/1/70	The Council on Environmental Quality (CEQ) in the Executive Office of the President administers action-forcing provisions that require federal agencies to submit environmental assessments and impact statements on proposed actions.
Clean Air Act (CAA) Amendments	1970 1977	The Environmental Protection Agency (EPA) sets national air standards and delegates enforcement to the states through EPA-approved programs.
Occupational Safety and Health Act	1970	The Occupational Safety and Health Administration (OSHA) in the Department of Labor sets and enforces environmental standards in the workplace.
Federal Water Pollution Control Act Amendments	1972	EPA sets national water standards and delegates enforcement to the states through EPA-approved programs. EPA and the Department of Defense (DOD)/Army Corps of Engineers enforces wetlands regulations, and the Department of Transportation (DOT)/Coast Guard enforces oil-spill provisions.
Clean Water Act (CWA) Amendments	1977	
Amendments	1981	
Amendments	1987	
Amendments	1988	
Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)	1972	EPA registers and classifies pesticides, certifies applicator training, and delegates enforcement to the states through EPA-approved programs.
Marine Protection, Research, and Sanctuaries Act (MPRSA) Amended by Ocean Dumping Ban Act	1972 1988	EPA, DOD/Army Corps of Engineers, and DOT/Coast Guard assist Department of Commerce (DOC)/National Oceanic and Atmospheric Administration (NOAA)/National Marine Fisheries Service in enforcing provisions regulating ocean dumping. Department of State handles international violations. Amendments ban ocean dumping of sludge and infectious medical waste.
Noise Control Act (NCA) Amended by Quiet Communities Act	1972 1978	EPA sets standards and delegates enforcement to the states through EPA-approved programs. OSHA enforces the law in the workplace.
Endangered Species Act (ESA) Amendments	1973 1982	Department of the Interior (DOI)/Fish and Wildlife Service, DOC/NOAA National Marine Fisheries Service, DOT/Coast Guard, Department of Agriculture, and Department of the Treasury enforce the law.
Reauthorized	1988	
Safe Drinking Water Act (SDWA) Amendments	1974 1977	EPA sets national standards and delegates enforcement to the states through EPA-approved programs.
Lead Contamination Control Act Amendments	1986 1988	
Atomic Energy Act Amendments Amended by the Uranium Mill Tailings Radiation Control Act	1974 1978	The Nuclear Regulatory Commission enforces the Atomic Energy Act and amendments to the act.

Law	Date	Implementation
Toxic Substances Control Act (TSCA)	1976	EPA tests new chemicals and bans those that pose unreasonable risk to public health or the environment.
Amended by Asbestos Hazard Emergency Response Act (AHERA)	1986	
Resource Conservation and Recovery Act (RCRA)	1976	EPA enforces cradle-to-grave tracking of hazardous wastes and delegates enforcement to states through EPA-approved programs.
Amended by the Hazardous and Solid Waste Act (HSWA)	1984	
Amendments	1986	
Amended by Medical Waste Tracking Act	1976	
Hazardous Materials Transportation Act (HMTA)	1976	Department of Transportation and the Treasury Department's Customs Service enforce the packaging and transport of hazardous materials on land and sea and in the sky.
Surface Mining Control and Reclamation Act (SMCRA)	1977	DOI/Office of Surface Mining Reclamation and Enforcement enforces regulations for cleanup of surface mining sites.
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund)	1980	EPA enforces regulations requiring responsible parties to clean up hazardous substance sites or to cover the costs of government cleanups funded by the multi-billion dollar Superfund set up by Congress for emergency use. DOD/Army Corps of Engineers and some states cooperate with EPA on removal and remedial actions.
Superfund Amendments and Reauthorization Act (SARA)	1986	EPA enforces Title III of SARA that requires all manufacturers, importers, processors, and users of more than 300 hazardous chemicals to report annually on releases to the environment.
Emergency Planning and Community Right-to-Know Act (EPCRA)	1986	
Nuclear Waste Policy Act (NWPA)	1982	Nuclear Regulatory Commission enforces regulations regarding the storage and disposal of high-level radioactive waste, spent nuclear fuel, and low-level nuclear waste. EPA sets standards for radiation in surface and drinking water, air, precipitation, and milk.
Federal Food and Drug Control Act (FFDCA)		EPA sets maximum legal limits for pesticide residues on food and feed grains. The Department of Agriculture enforces tolerances for meat and poultry, and the Food and Drug Administration enforces tolerances for all other food products in interstate commerce.
Shore Protection Act (SPA)	1988	DOT/Coast Guard enforces regulations regarding pollution of beaches and coastlines.

Source: Council on Environmental Quality, *Environmental Quality: Twentieth Annual Report* (Washington, D.C.: U.S. Government Printing Office, 1992).

