Pollution Control Today

2

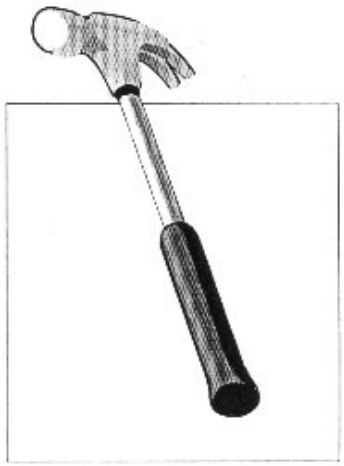
In the 25 years since the issue of environmental protection first exploded onto the American political agenda, Congress has enacted and revised dozens of relevant statutes. Most of these laws are regulatory in nature; they are designed to change private conduct in ways that will help preserve and protect the human environment. In this chapter, we characterize which pollution problems are regulated today or are likely to be in the near future.

In the first section, we look at pollution control from two perspectives. First we outline where our pollution control dollars are being spent today and briefly review the progress cleaning up the environment over the last two decades. After that, we present one view of the pollution problems that still remain.

In the second section, we present four case studies that illustrate the issues raised when "real world" environmental programs are designed and implemented. Specific instruments are chosen to achieve environmental goals, but they obviously must satisfy other criteria as well. Each program offers a glimpse of the various ways each of the seven criteria (briefly presented in chapter 1 and discussed more fully in chapter 4) have been or could have been taken into account to choose effective policy tools.

The case studies illustrate the use of instruments that directly limit pollution and those that lower pollution but do not set fixed targets. In the first group we describe the use of tradeable emissions in an air pollution control program in the Los Angeles area and the use of integrated permitting in New Jersey. These two policy tools are among the less used, but quite promising, approaches in the environmental policy toolbox.

Many of the instruments considered in this study do not have fixed pollution targets. The third case study illustrates one of



these, information reporting, by discussing two California programs: Proposition 65 and the Air Toxics "Hot Spots" program. Our fourth case study focuses on technical assistance, as used under the Massachusetts Toxics Use Reduction Act.

TODAY'S PROBLEMS

Before we move on to consider the values and interests policymakers bring to problem solving, we need to take a quick look at the kinds of problems we are working on today and may face tomorrow. After all, our choice of policy tools is likely to be in large part influenced by the characteristics of the problem being addressed.

Today the United States is spending about $100 billion per year controlling and preventing pollution. While controlling pollution more wisely may lower these costs, the demands from a growing economy can be expected to offset some of, or even overshadow, these gains. Understanding which problems require the largest expenditures and who pays the bills can help identify those targets that may yield the largest cost savings. There are certainly many inefficiencies in the way the nation protects the environment. It makes sense to look first at those areas that cost the most.

But knowing the problems most of the money is spent on today illuminates only part of the picture. Even with today's substantial investment of money and effort, many environmental problems remain and new ones may emerge. Later in this section we review the results of an EPA exercise to rank remaining environmental priorities in each of the 10 EPA regions. The wide variety of types of remaining problems and sources identified in this exercise underscores the need for a diverse set of policy tools.

The Cost of Pollution Abatement

About 85 percent of the approximately $100 billion spent annually on pollution abatement is tied to the requirements of the Clean Air Act (CAA), the Clean Water Act (CWA), and the Resource Conservation and Recovery Act (RCRA)—the three statutes covered in this report—or similar state and local programs. Figure 2-1 displays current environmental expenditures under these and other environmental statutes. About one-third of the total is spent controlling water pollution; somewhat over 20 percent controlling air pollution; another 20 percent disposing solid waste; 15 percent preventing, treating, and storing hazardous waste; 5 percent cleaning up old hazardous waste sites; and about 1 to 3 percent each on drinking water, pesticides, and other toxic chemical programs.

As can be seen in figure 2-2, about 45 percent of the total is spent by government (with local government spending the largest share), 40 percent by business, and 15 percent directly by households.

Again, about one-third of today's abatement costs are spent to maintain and improve the quality of the nation's surface water. The vast majority of this expenditure is to clean up wastewater from identifiable municipal and industrial sources. While many of these sources have significantly reduced their discharges over the last 25 years, many lakes, streams, and estuaries are still impaired. Another source of water pollution—nonpoint source pollution from agricultural and urban runoff—is ranked among the very top of remaining risks to ecosystems. Relatively little is spent on controlling nonpoint source pollution today; moreover, the costs of controlling many of these sources in the future might also be quite high.

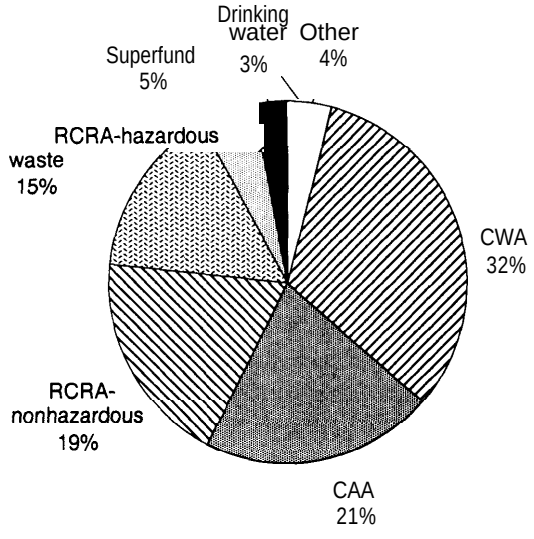
Of the total water pollution control costs, close to 65 percent is spent by federal, state, and, primarily, local governments. Business spends about 30 percent and the remainder is spent directly by households.

Information on water quality trends—that is, the progress made over the last two decades—is almost completely lacking. Much anecdotal information and data collected by the U.S. Geological Survey (USGS) on a limited number of sites nationwide indicate some improvement for some contaminants (e.g., bacteria and phosphorus). However, for other contaminants (e.g., dissolved oxygen and nitrates), the USGS data show no discernible trend (91).

Although data are sketchy even about *today's* water quality, currently about 40 percent of the nation's river miles that have been assessed either do

FIGURE 2-1: Pollution Abatement Expenditures, by Statute, 1991

U.S. total approximately $100 billion/year



SOURCE: Office of Technology Assessment, modified from Don Garner, "Pollution Abatement Costs," Contractor Report to OTA, 1994.

not support, or only partially support, the beneficial use designated by the state (e.g., swimming, fishing, drinking, or support of aquatic life). About 45 percent of assessed lake area and 35 percent of estuaries do not support, or only partially support, designated use (212). Agriculture is thought to be the single largest source of remaining river and lake water quality problems. Sewage treatment plants and urban runoff are the largest contributors to remaining estuarine water quality problems.

Somewhat over 20 percent of today's abatement expenditures are for air pollution control. These expenditures have contributed to a 25 percent drop in emissions of carbon monoxide, sulfur dioxide, and volatile organic compounds since 1970. Particulate matter has dropped about 50 percent and lead emissions have dropped by 98 percent since 1970. Nitrogen oxide is the only criteria air pollutant to have increased since 1970, by about 10 percent (205).

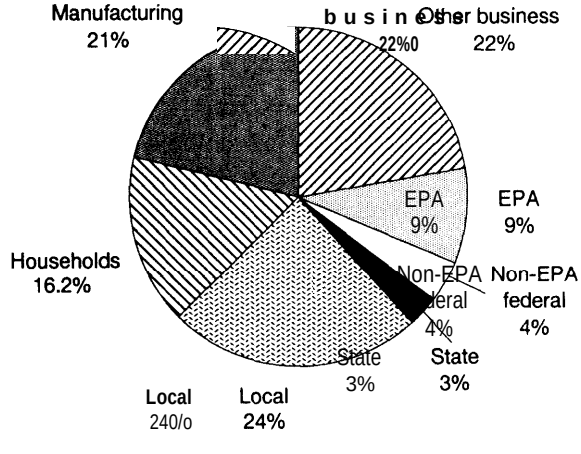
However, much remains to be done. Many areas still do not meet air quality standards for criteria air pollutants such as urban ozone. About 60 million people live in counties with air quality levels that do not meet the national standards for one or more pollutants. About 50 million people live in counties that exceed air quality standards for urban ozone. About 12 million people live in counties that exceed air quality standards for carbon monoxide, and about nine million people live in counties that exceed standards for particulate matter (21 1). The recently amended program to control emissions of hazardous air pollutants is still in its early stages.

In contrast to water pollution control, most air pollution control costs are borne by the private sector. About 55 percent is spent by business and 35 percent by households (primarily for auto pollution control devices).

Just under 20 percent of total costs are spent on solid waste. As we shall see in the next section, municipal solid waste is often judged to be among the lower risks to both human health and natural

FIGURE 2-2: Pollution Abatement Expenditures, by Sector, 1991

U.S. **total approximately $100 billion/year**



SOURCE: Office of Technology Assessment, modified from Don Garner, "Pollution Abatement Costs," Contractor Report to OTA, 1994

ecosystems. However, siting landfills is becoming increasingly difficult, which results in higher disposal costs. Per capita net discards of solid waste have been declining over the past decade due in part to increased rates of recycling, but not fast enough to offset population growth (48). Solid waste disposal costs are shared about equally between government and the private sector.

Another 20 percent of the total is spent on hazardous waste. About three-quarters is spent dealing with hazardous waste under RCRA and the remainder to clean up existing hazardous waste sites under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA, also called Superfund). Most of the costs of dealing with hazardous waste are borne by business.

The remaining 10 percent of the total is spent on regulations under the Safe Drinking Water Act, regulating pesticides under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), regulating new chemicals under the Toxic Substances Control Act (TSCA), and a few other statutes implemented by EPA. Most of the drinking water costs are spent by government and the bulk of the costs under the other statutes is spent by the private sector. As we shall see in the next section, the risks from drinking water and pesticides rank quite high on comparative assessments of risk.

Figure 2-3 breaks down pollution abatement expenditures by both statute and sector. Again, of the $100 billion per year spent on capital and operating costs, government and businesses each spend between 40 and 45 percent of the total. Households pay the remainder, about 15 percent.

Among businesses, expenditures are about equally divided between manufacturing and other businesses, for example, electric utilities and mining. Of the government expenditures, local government by far spends the most, about one-quarter of the nation's total.

The bulk of the expenditures by business is for air pollution control, water pollution control, and dealing with hazardous wastes under RCRA and CERCLA. Businesses spend between 10 and 12 percent of the total abatement expenditures from all sectors in each of these three areas. Households spend about 7 percent of the total for cleaner cars and gasoline and an additional 5 percent for solid waste disposal.

The largest government expenditures are for water pollution control. About 16 percent of total pollution control costs are spent by state and local government on publicly owned treatment works (POTWs) and other sewerage. The federal government spends an additional 4 percent through the State Revolving Fund. Government costs for solid waste disposal are also significant. About 9 percent of total pollution abatement costs is spent by local governments dealing with trash. In addition to funds appropriated to states and local governments to help build POTWs, the federal government spends a significant amount on hazardous waste. Some of this, over 3 percent of nationwide costs, is spent on Superfund. A similar and rapidly increasing amount is spent dealing with hazardous waste at government facilities.

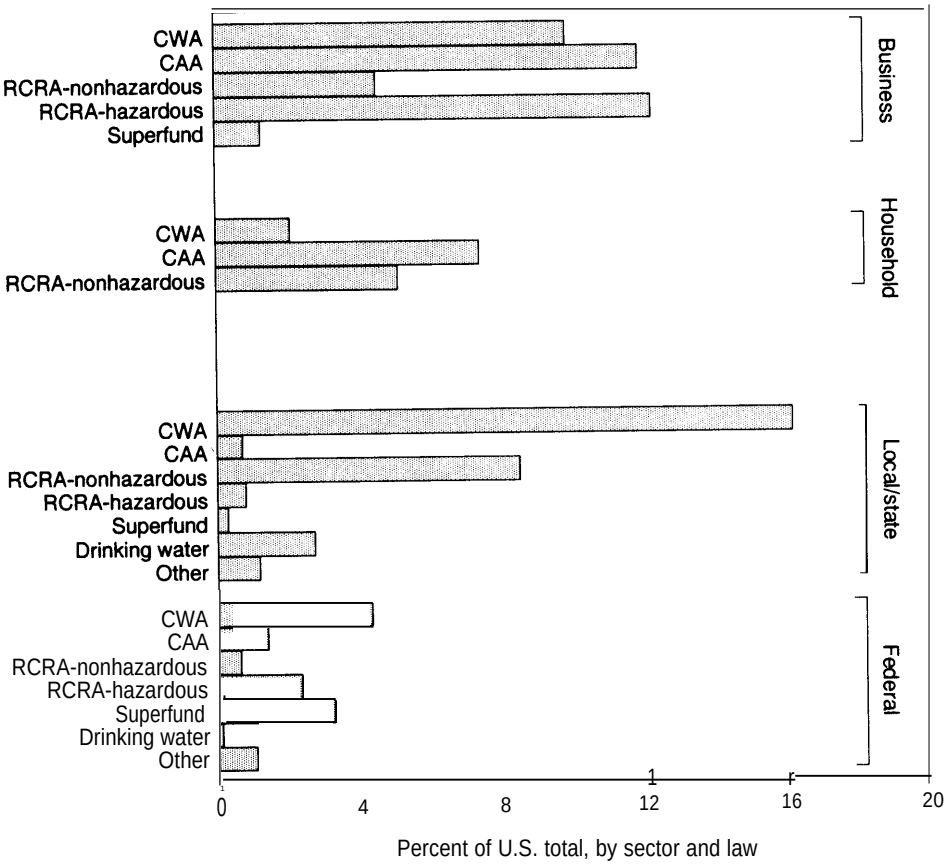
Pollution abatement expenditures are a small but noticeable percentage of expenditures within each of these sectors. Total expenditures are equal to about 2 percent of the gross national product.

Government expenditures, on a percentage basis, are somewhat higher than private sector expenditures. Close to 4 percent of local government expenditures are devoted to environmental protection, again with most of this going to sewage treatment and solid waste disposal. Close to 1.5 percent of federal expenditures (not counting Social Security or Medicare) are for pollution abatement.

Less than 0.5 percent of household expenditures go to pollution abatement. By businesses, this percentage is just under 1 percent of the value of shipments. However, as shown in figure 2-4, this percentage varies considerably. Figure 2-4 displays pollution abatement costs as a percentage of value of shipments for manufacturing and several major nonmanufacturing industries. These costs are disaggregated to the finest resolution available—the four-digit standard industrial code (SIC).

Control costs are as high as 9 percent of value of shipments, but for very few industries. For the 11 four-digit SIC industries where control costs ex-

FIGURE 2-3: Pollution Abatement Expenditures, by Statute and Sector, 1991



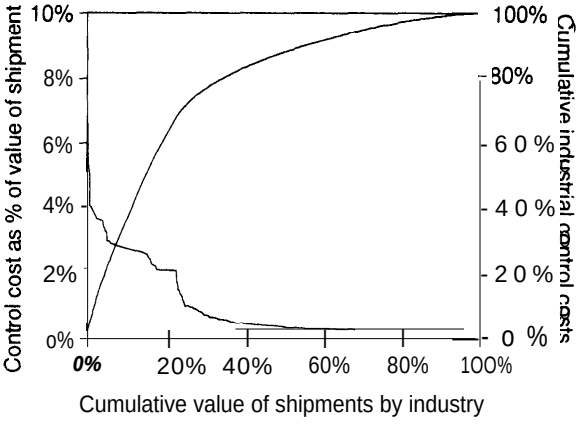
SOURCE: Office of Technology Assessment, modified from Don Garner, "Pollution Abatement Costs," Contractor Report to OTA, 1994.

ceed 4 percent of value of shipments, their total value of shipments is about 1 percent of the industrial total. Those industries whose control costs exceed 2 percent of value of shipments spend close to two-thirds of industrial control costs but are responsible for about 20 percent of the value of shipments. Those industries where control costs are less than 1 percent of value of shipments are responsible for about 75 percent of the total value of shipments.

If media attention were the only guide, one might assume that the bulk of the nation's pollution abatement expenditures was devoted to dealing with hazardous materials, with very little of it spent on pollution prevention. This is not the case. Using the above estimates as a rough guide, about one-third of abatement costs are spent on hazardous pollutants. The rest is for controlling criteria air pollutants such as ozone and particulate, conventional water pollutants such as suspended solids and oxygen-demanding materials, and solid waste.

Pollution prevention is more prevalent than is usually recognized. The only reliable data on pollution prevention versus end-of-line control methods are for capital expenditures within manufacturing. The last decade has seen a marked increase in the use of pollution prevention. During

FIGURE 2-4: Pollution Abatement Costs versus Value of Shipments by Industry, 1991



SOURCE: Office of Technology Assessment, modifled from Don Garner, "Pollution Abatement Costs," Contractor Report to OTA, 1994

the early 1980s, manufacturers reported about 15 percent of their abatement expenditures for pollution prevention. Over the last 10 years, this has doubled. A U.S. Census Bureau survey estimates that about 35 percent of capital expenditures in 1992 were for pollution prevention. This varies somewhat by medium, ranging from about 25 percent for water pollution control, to 35 percent for waste, to about 43 percent for air pollution control.

Remaining Environmental Problems

Tomorrow's environmental agenda will contain many new priorities, but much of it will be filled with problems that remain from yesterday. This is the conclusion of several reports that have attempted to assign qualitative rankings for today's major environmental risks as part of an effort for setting tomorrow's environmental priorities. These include two national studies and comparative risk exercises by all 10 EPA regions and by six states.

As might be expected, there are both similarities and significant differences among the results. Some of these differences are due to the fact that environmental problems vary from region to region. Other differences stem from the regrettably crude state of the art of comparative risk assessment. While such attempts do help identify significant environmental problems, they also make clear that: 1) much of the information needed to compare risks is not available; and 2) priority setting depends as much on values as estimates of harm.

Some of the problems identified have been addressed by the major environmental laws for two decades but have been resistant to solution. Others have received little attention to date. They are found in all media—air, water, and land-and they include both risks to human health and risks to natural ecosystems.

The first of these reports, *Unfinished Business,* was prepared by EPA in 1987. EPA first identified 31 environmental problem areas and then qualitatively identified and ranked the remaining risks to human health, ecological, and social welfare.

The key risks to human health identified by the report included the following:

- indoor air pollutants, including radon;
- worker exposure to chemicals;
- pesticides;
- criteria air pollutants, such as fine particulate and urban ozone;
- consumer product exposure;
- hazardous air pollutants;
- drinking water; and
- accidental releases of toxics.

Note that the health risks within this highest category are *not* ranked, due to both data limitations and the difficulty of comparing cancer and noncancer health risks.

Unfinished Business judged the following ecological risks as greatest:

- global warming;
- stratospheric ozone depletion;
- physical alteration of aquatic and terrestrial habitats; and
- mining and gas and oil extraction.

The report ranked several ecological risks somewhat lower, but still high:

- criteria air pollutants;
- point source discharges of water pollutants;

- nonpoint sources of water pollutants; and
- pesticides.

Several years later, EPA's Science Advisory Board (SAB), in response to a request by the EPA Administrator to review *Unfinished Business*, issued its own list of the most significant environmental risks. The SAB Human Health Committee felt that four of the high-risk human health problems identified by *Unfinished Business* were firmly supported by available data:

- ambient air pollutants, including both criteria air pollutants and hazardous air pollutants;
- indoor air pollution;
- worker exposure to chemicals in both industry and agriculture; and
- pollutants in drinking water.

The committee stated that many of the other areas identified by *Unfinished Business* involved "potentially significant exposure of large populations," but that the "data bases to support these concerns are not as robust" as for the four problems listed above.

The Ecology and Welfare Committee identified four high risks:

- global warming;
- stratospheric ozone depletion;
- habitat alteration and destruction; and
- species extinction and overall loss of biological diversity.

Two of the ecological risks ranked relatively high by *Unfinished Business* were ranked as medium-risk problems by the SAB committee:

- water pollution, such as toxics, nutrients, biochemical oxygen demand, and turbidity; and
- pesticides.

Recognizing that such nationwide rankings could not adequately reflect the regional variation among environmental problems, EPA asked each of the 10 EPA regions to undertake comparative risk-ranking exercises and sponsored similar exercises by the states. Results of the regional exercises, displayed as figures 2-5 and 2-6, illustrate regional variation and, once again, differences of opinion among different groups doing the evaluations.

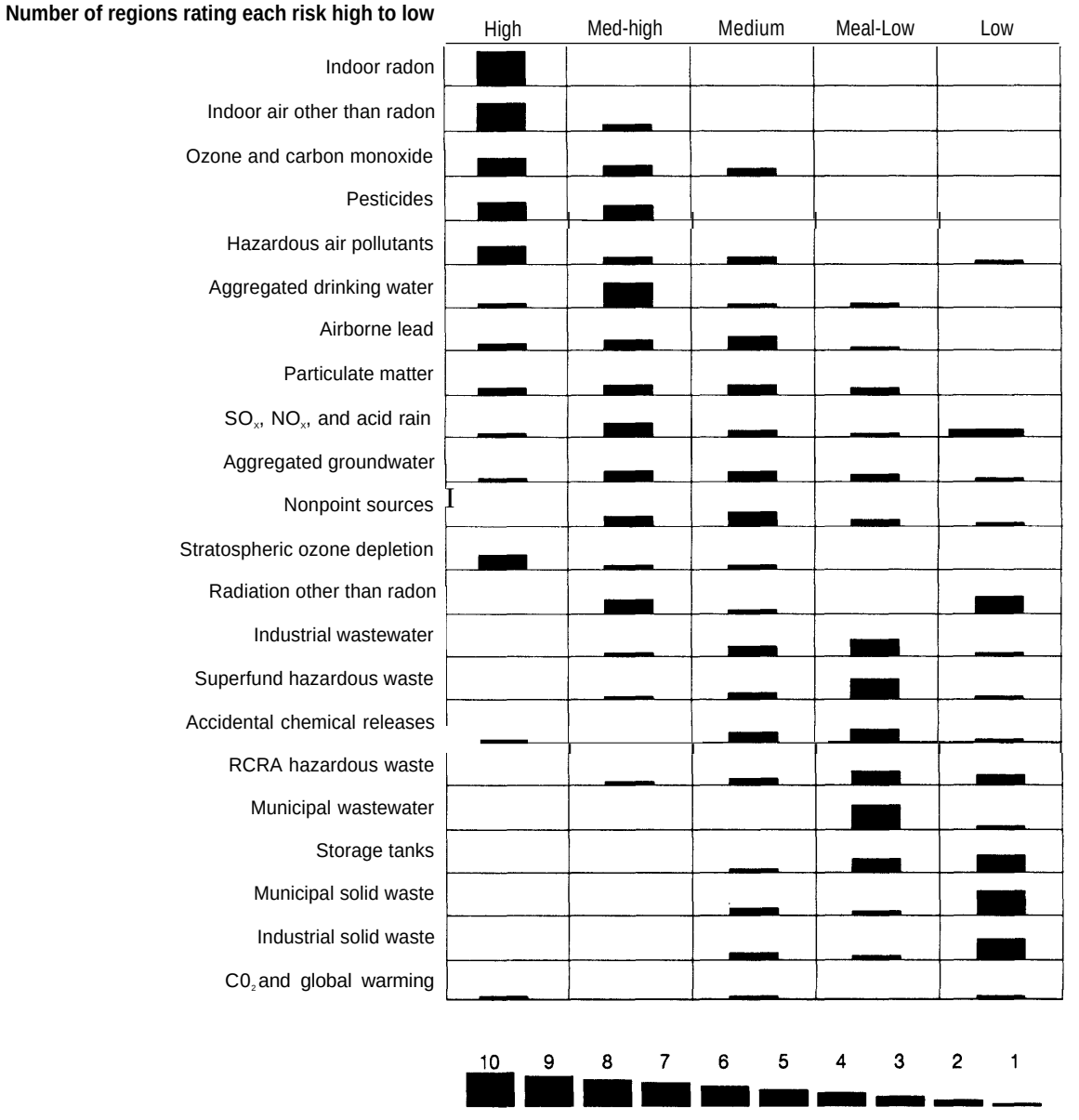
Figure 2-5 displays the number of EPA regions rating each of approximately 20 problem areas as high, medium-high, medium, etc., with regard to risks to human health. The categories are similar but not identical to those used in *Unfinished Business* and the SAB report. For example, the category of "criteria air pollutants" is further disaggregated to ozone and carbon monoxide, particulate matter, airborne lead, and sulfur and nitrogen oxides. Several of the earlier categories are missing (including worker exposure to chemicals, rated as one of the highest risks, but not within EPA's jurisdiction). The order in the figure displays a rough nationwide ranking,[1] by ordering those risks rated highest by the most EPA regions first. Note, however, the widely scattered results: three-quarters of the risks were rated as high or medium-high by at least one EPA region.

The rough nationwide ordering that results from combining each of the 10 independent regional comparative risk exercises tracks fairly closely to the nationwide studies discussed above. The highest ranked human health risks include some risks that we have been grappling with for many years (e.g., ozone and carbon monoxide, pesticides, and drinking water), risks that only recently have been recognized as major and not well addressed by our current system (e.g., indoor air pollution, including radon), and at least one (hazardous air pollutants) that has recently been addressed by a significantly expanded regulatory program.

Figure 2-6 displays the rankings of ecological risks by the 10 EPA regions. Physical alteration of natural habitats are ranked high by all of the risk-ranking exercises—all 10 EPA regions and the two nationwide exercises. The nationwide exer-

[1] Risks were ordered from highest to lowest by assigning 5 points for each region that rated a risk as high, 4 points for a medium-high rating, 3 points for a medium rating, etc. Other weighting schemes would, of course, result in somewhat different rankings.

FIGURE 2-5: Ranking of Human Health Risks, Ratings by 10 EPA Regions

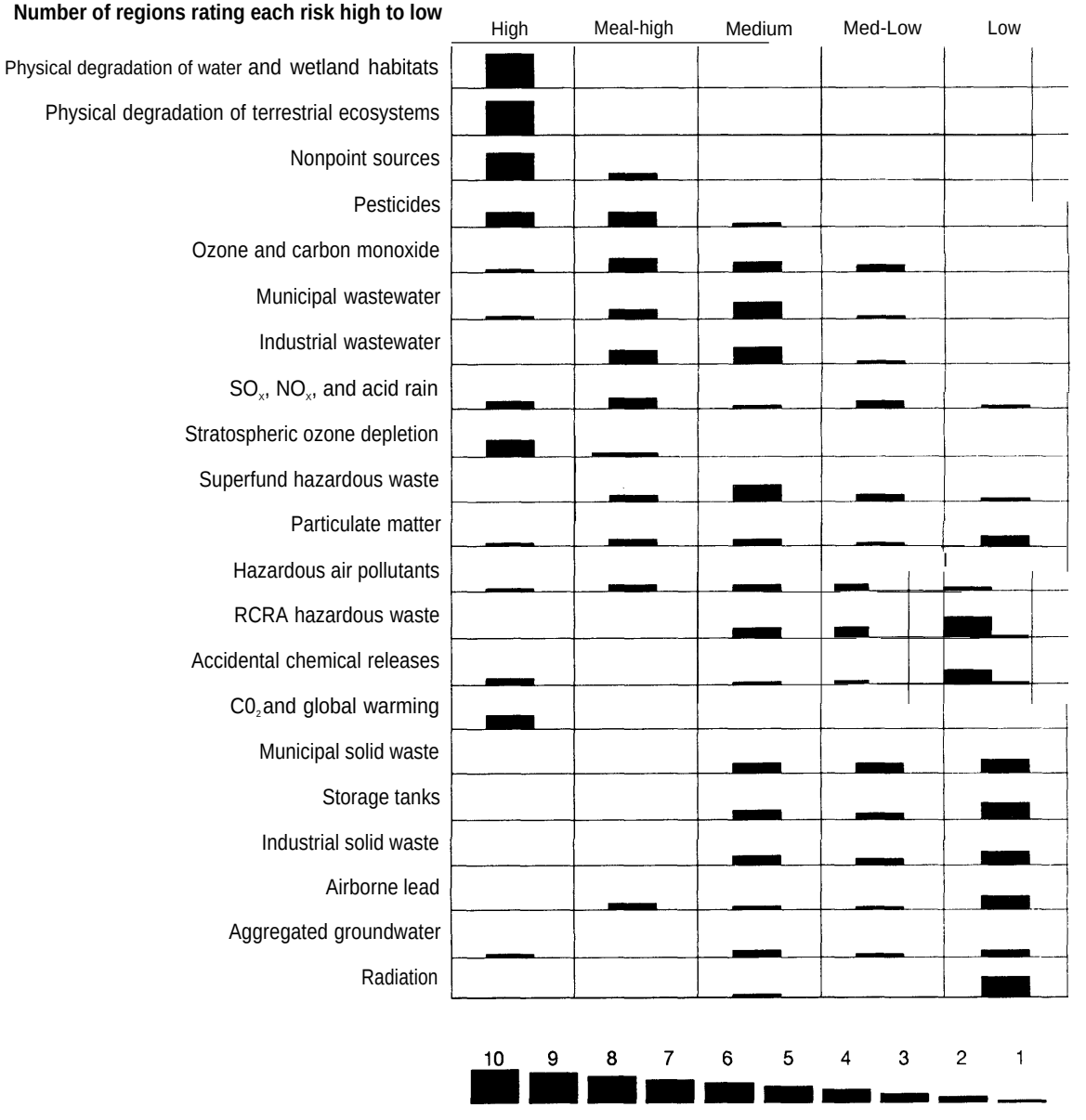


SOURCE: Data on regional rankings provided by R. Curry, Strategic Planning and Management Division, U.S. Environmental Protection Agency.

cise ranked two global issues—global warming and stratospheric ozone depletion—higher than the regional efforts. The regional efforts ranked more localized problems, such as nonpoint source water pollution, pesticides, and ozone, higher than the nationwide exercises. This may have been due to a difference of opinion or values, or merely that the regions felt that their job was to identify risks for *regional* attention.

Some of the problems mentioned above pose risks to both human health and ecosystems, for example, pesticides, stratospheric ozone depletion,

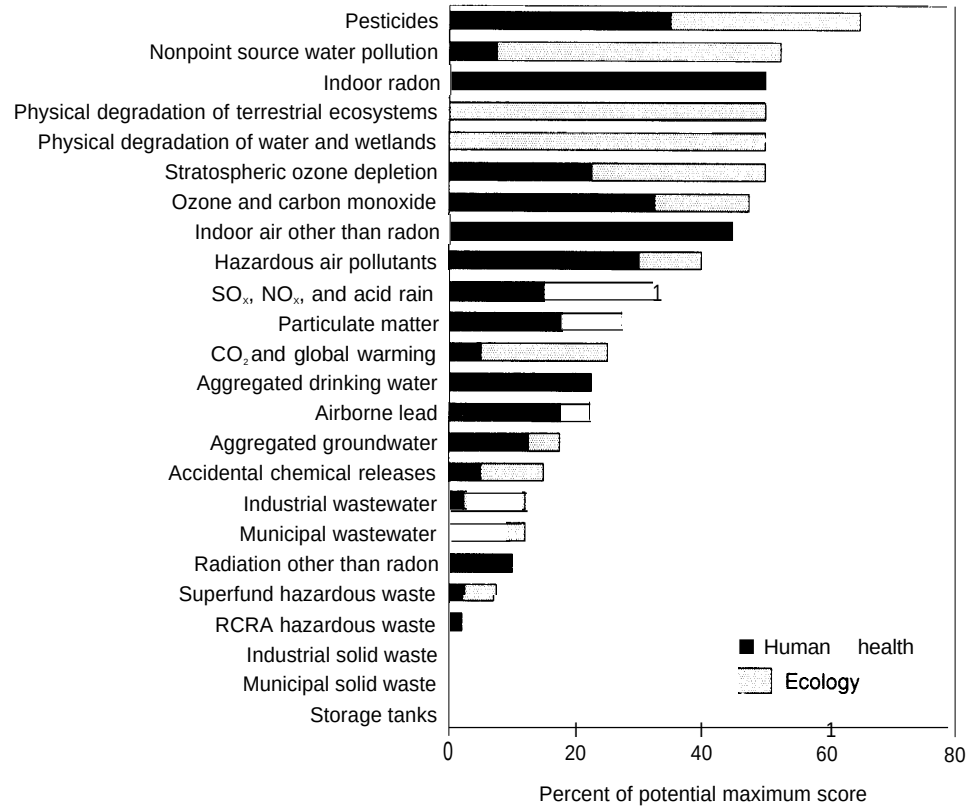
FIGURE 2-6: Ranking of Ecological Risks, Ratings by 10 EPA Regions



SOURCE: Data on regional rankings provided by R. Curry, Strategic Planning and Management Division, U.S. Environmental Protection Agency

and criteria air pollutants such as ground level ozone and sulfur and nitrogen oxides. Others pose risks primarily to one or the other, for example, physical alteration of natural habitats, nonpoint source water pollution, and indoor air pollution, including radon. Figure 2-7 displays a rough "combined risk ranking" of the combined concerns of the 10 EPA regions. The ranking assumes that equal concern is given to human health risks and ecological risks. Weighting one more than the other would, of course, result in different rankings.

FIGURE 2-7: Combined Human Health and Ecological Risk, Rankings by 10 EPA Regions



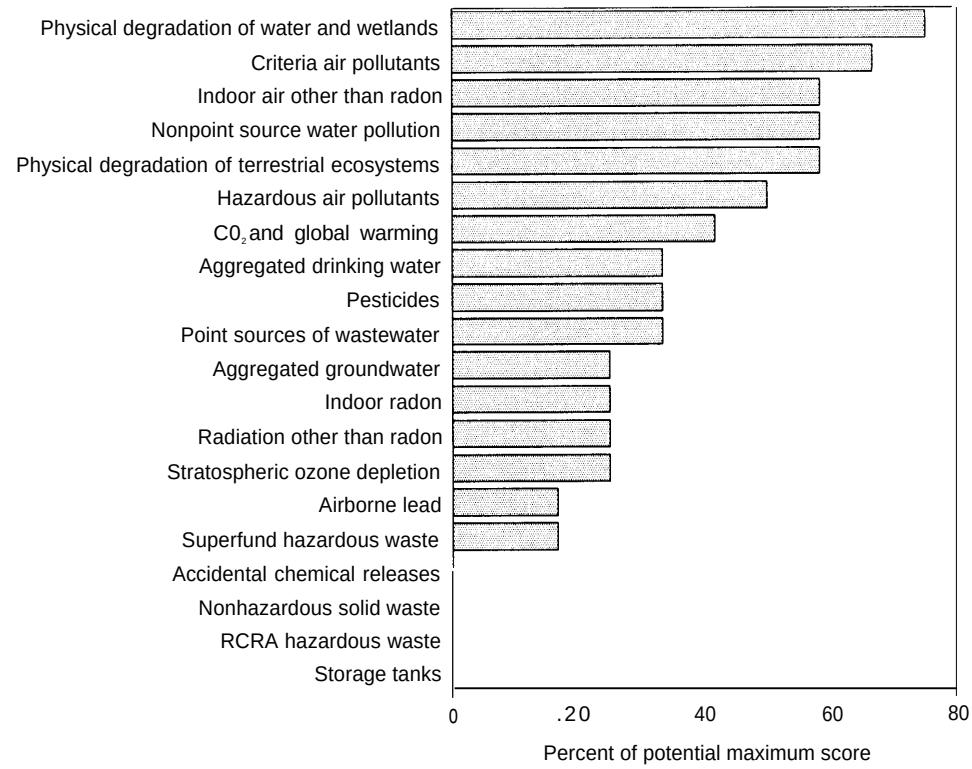
SOURCE: Office of Technology Assessment, based on data on regional rankings provided by R. Curry, Strategic Planning and Management Division, U.S. Environmental Protection Agency,

EPA has sponsored risk-ranking exercises by states as well. Figure 2-8 displays the results of these exercises by six states: California, Colorado, Louisiana, Michigan, Vermont, and Washington. All but California provided integrated risk rankings, that is, evaluated each of the problems by considering all of the risks—both to human health and to ecosystems—that they pose. Note the somewhat similar ranking of the most serious problems by the EPA regions and the states, with a few notable exceptions: indoor air pollution, pesticides, and stratospheric ozone depletion are considerably further down the states' lists. Complicating the comparison, however, is that not all the states followed the same procedure. Some of the states (e.g., Washington and Louisiana) ranked priorities for state action while others (e.g., Vermont and Colorado) ranked risks to the state, regardless of whether they felt state action was appropriate.

MATCHING TOOLS TO PROBLEMS

The case studies examined in this chapter illustrate the issues raised when real-world environmental programs are designed and implemented. Specific instruments are chosen to achieve environmental goals. These choices offer at least some glimpses of the various ways each of the seven criteria briefly presented in chapter 1 and discussed

FIGURE 2-8: Combined Human Health and Ecological Risk, Rankings by Six States



SOURCE: Office of Technology Assessment, based on data on state rankings provided by D. Martin, Strategic Planning and Management Division, U.S. Environmental Protection Agency.

more fully in chapter 4 have been taken into account.

The first two case studies illustrate several of the less commonly used—but especially promising—instruments with fixed emissions targets: tradeable emissions and integrated permitting. The latter two case studies illustrate two of the available approaches without fixed targets: information programs and technical assistance. The specific examples and criteria discussed in each case study are shown in box 2-1.

▮ RECLAIM Tradeable Emissions Program

The Regional Clean Air Incentives Market (RECLAIM) is one of the biggest experiments in environmental regulation in the United States. Many stakeholders took part in the lengthy negotiation necessary to formulate and adopt a controversial pollution control program. Emissions trading, long discussed in economic literature and adopted in the 1990 Amendments to the Clean Air Act (CAA) for controlling acid rain, is the focus and hope for more cost-effective air pollution emissions reduction in the South Coast Air Quality Management District (District).

RECLAIM, first implemented in January 1994, took three years to develop because of an unusually open and public process. Growing federal interest in alternative regulatory approaches and serious concern with the cost of air pollution control in California's troubled economy spurred

BOX 2-1: Case Studies: Tools, Criteria, and Key Issues

Tradeable Emissions

RECLAIM, Los Angeles area:

Cost-effectiveness and fairness: As reductions to meet air quality standards became increasingly expensive under the previous control plan, both industry and government began searching for ways to lower emissions more cost-effectively. The perception of what is a "fair" initial allocation of permits and a fair rate of reductions differed among stakeholders.

Assurance of meeting goals: State-of-the-art monitoring **was a** crucial component for ensuring that individual sources were accountable for reductions and that the program could be enforced. This ultimately limited the types of sources that could participate.

Environmental equity and justice: Public interest groups were concerned that trading might lead to higher ozone levels in predominantly Black and Hispanic areas, compared with levels under the source-specific program it replaced.

Integrated Permitting

New *Jersey:*

Pollution Prevention: The program requires formal facility-wide pollution prevention planning as a condition for integrated permitting.

Adaptability: The integrated permit incorporates a range of acceptable changes, allowing a facility to quickly make process changes in response to market opportunities without needing additional agency approvals.

Information programs

Proposition 65 and "Hot Spots" program, California:

Assurance of meeting goals: Although both programs establish incentives for lowering exposures to toxics, neither provides much assurance to the public that goals will be met. The "Hot Spots" program was amended several years later to require reductions.

Pollution prevention: Proposition 65 assumes that consumers will reject products using toxics, thus pressuring companies to prevent pollution by finding substitutes.

Environmental equity and justice: Giving communities or individuals information about risks or about emissions can improve their ability to identify potential dangers. Both programs report risk—as opposed to emissions asunder the federal Toxics Release Inventory—an easier measure for the public to interpret.

Technical Assistance

Toxics Use Reduction Act, Massachusetts:

Adaptability to change: A service unit oriented toward client needs can incorporate changes in these needs and modify its practices in response to information about new technologies or changed understanding of risk rather easily in comparison to other types of instruments.

Technology innovation and diffusion: A focus on small firms without R&D capability and efforts to link experts can facilitate diffusion and might improve chances for innovation. Institutional and geographic separation of a state's R&D group from its outreach group may diminish opportunities for learning and cross-fertilization of ideas.

SOURCE: Office of Technology Assessment, 1995,

the District to attempt a major experiment in regulation.[2]

District regulators were faced with many challenges before program development even began—for example, the need to fit into an already elaborate regulatory structure at the state and federal level. The RECLAIM program, which is part of the District's Air Quality Management Plan (AQMP), must be approved by the California Air Resources Board (CARB) to be incorporated as part of the State Implementation Plan (SIP) to demonstrate compliance with both the federal CAA and the California Clean Air Act (CCAA) (180).

In addition, the District accepted five criteria that were used to further guide RECLAIM development (179):

- enforcement of emission reductions must provide confidence equal to or greater than the existing air quality control program;
- emission reductions must be equal to or greater than the 1991 Air Quality Management Plan (AQMP) and future control plans;
- implementation costs must be less than the 1991 AQMP;
- job impacts must be less than the 1991 AQMP; and
- adverse public health impacts should not result from implementation of the program.

The development process began in 1990 and included numerous meetings, hearings, and workshops over a several-year period. Although RECLAIM has been in place for less than two years, the story of its selection and design as a regulatory approach is of particular interest as an example of regulatory decisionmaking and the tradeoffs that are made in the process.

How RECLAIM Works

At the most basic level, RECLAIM establishes an emissions trading market for stationary sources in the District that emit four tons or more of nitrogen oxides (NO_x) or sulfur dioxide (SO_2) per year.[3] At the time of implementation, total RECLAIM sources included 41 SO_2 facilities (representing approximately 85 percent of the reported SO_2 emissions from stationary sources in the District) and 390 NO_x facilities (representing about 65 percent of permitted NO_x stationary source emissions in the District) (180). Each facility receives a facility permit, which includes a list of all emission sources, annual reduction targets, quarterly emission limits, and compliance requirements in accordance with requirements of the CCAA and the federal CAA. This permit establishes the facility-wide emission level for each year from 1994 to 2003 and the corresponding annual allocation of Regional Trading Credits (RTCs) as determined by the District (based on past peak production and requirements of existing rules and regulations). An RTC represents one pound of either NO_x or SO_2 emissions and is a tradable commodity meant to be bought or sold for use within the year of its creation. Facilities must hold enough RTCs to cover their actual emissions.

The program is designed to require facilities to reduce emissions in the District by 8.3 percent per year for NO_x and 6.8 percent per year for SO_2 from 1994 through 2003 (102). It is expected that the presence of the emissions trading market will help lower the costs of meeting air pollution goals in the District as outlined by the 1991 AQMP. RECLAIM is a more flexible—and thus it is hoped more cost-effective—regulatory approach because it allows firms to control their emissions un-

[2] For example, see recent EPA rule on economic incentive programs: U.S. Environmental Protection Agency, "Economic Incentive Program Rules," final rule and guidance, *Federal Register* 59(67), Apr. 7, 1994.

[3] Separate trading markets exist for NO_x and SO_2. A volatile organic compound (VOC) market is in development and scheduled for adoption by fall 1995.

der a facility-wide emissions cap rather than requiring individual permits and controls for each emissions source in a facility. In addition, the RTC has value as one pound of NO_x or SO_2 emissions, and firms best able to make emission reductions may sell the credits to firms less able to make reductions for technical or economic reasons. In effect, RECLAIM allows firms to better "manage" their emissions by allowing more choice in how reductions are made and by placing a value on emission credits that creates an incentive to make reductions in order to sell those credits.

RECLAIM and the OTA Criteria

The selection and development process for RECLAIM involved detailed analysis of most of the decision criteria discussed in the previous chapter. Through the iterative nature of the program's design, stakeholders explicitly addressed assurance of meeting environmental goals, costs, equity and fairness, and technology innovation, among many other concerns. While all of these issues would be worth exploring, this case study will focus primarily on three of the OTA criteria: 1) fair and cost-effective use of resources; 2) environmental justice; and 3) assurance of meeting environmental goals.

Cost-effectiveness and fairness to sources

Cost-effectiveness—Lowering the high cost of control was one of the primary motivating factors for choosing emissions trading as a regulatory approach in the District. The economics literature and the early feasibility studies conducted for RECLAIM development provided theoretical support that emissions trading could help lower the costs and impacts on society while achieving the necessary pollution reductions (128,178). The conditions seemed right for a trading program with the large number of identifiable stationary sources, all of whom faced inherent variations in control costs.[4] Emissions trading offered flexibility to the regulated entities while maintaining a firm target of pollution control.

Just how significant cost savings will be under the RECLAIM regulatory approach is difficult to determine. While extensive analysis was conducted on the costs to the regulated industry groups (181), disaggregating down to a firm level was not possible, primarily because of a lack of facility-specific information. Various assumptions were made—including information on air pollution control technology currently in place, past production levels, and projected growth—in order to begin to model likely sellers and buyers and other impacts of a trading market (103). In addition, very little analysis is available on the relevant government costs. With these limitations in mind, the District's analysis did show that the costs of emission reductions with RECLAIM would be on the order of one-quarter to one-third less than the approach previously outlined in the 1991 AQMP in the years 1996-1999 (181). These cost estimates for RECLAIM were obtained through use of two forecasting models and include compliance, opportunity, and increased monitoring costs associated with the program.

It is assumed that under this type of market system, firms will choose the least expensive means of pollution control. Since RECLAIM establishes a facility emissions cap, eliminating most source-specific pollution control measures, firms are able to utilize many different options to make emission reductions including process changes, installation of control equipment, purchases of emission credits, and changes in operating or other methods (181). The RECLAIM cost-savings projection assumes that facilities will better "manage" their emissions by shifting from relatively high-cost controls to relatively lower-cost sources, both making the needed reductions and potentially freeing up RTCs for sale on the market. In addition, firms that are not able to make cost-effective reductions can potentially purchase RTCs on the

[4] The earliest program proposal included markets in VOC and NO_x, which potentially would have included approximately 2,700 facilities. South Coast Air Quality Management District, "RECLAIM: Feasibility Study," Diamond Bar, CA, March 1992.

market at a lower cost. Whether firms actually do maximize profits will vary, though the connection between emission reductions and the bottom line should motivate firms to take advantage of savings wherever possible in the system.

Compliance costs for both RECLAIM and the approach outlined in the 1991 AQMP include capital, operating, and maintenance expenditures on control equipment. Although overall costs are estimated to be lower under RECLAIM, some industry groups are winners and some are losers. Those expected to gain the most include public utilities, petroleum, stone and clay, and the construction industries. Industries expected to pay more under RECLAIM include primary metals, paper, and mining (181). These cost savings for firms are expected to be bolstered by new technologies available with the expanded incentive for innovation due to the presence of the market. The positive finding for cost savings to industry also implies lower future job impacts due to regulation. RECLAIM analysis shows an expected 1,100 fewer jobs lost annually on average between 1994-1999 under RECLAIM than the earlier plan (181).

Determining cost-effectiveness for firms in an emissions market also requires consideration of costs associated with monitoring, recordkeeping, and transactions. District analysis estimates that total control costs for NO_x and SO_2 RECLAIM firms will be about $75 million per year in 1996 and $165 million by 1999. The District estimates that average cost of monitoring and recordkeeping (as part of control costs) will be about $13 million per year between 1994 and 1999. That estimate reflects approximately $10 million for use of Continuous Emission Monitoring Systems (CEMS), and about $2 million for Continuous Process Monitoring Systems (CPMS). The remaining $0.3 million is assigned to operating costs for Remote Terminal Units (RTUs) in some facilities (181).

Of course, whether these estimated cost savings come about depends on how closely the modeled assumptions match what actually happens. Looking more closely at what is forecast to happen in a typical year, 1997, is instructive. In this year, RECLAIM is expected to cost $94 million in comparison to $127 under the old AQMP, a savings of about $34 million or 25 percent. Some of this savings is assumed to come from more rapid innovation that might occur under a trading scheme. As discussed in chapter 4, this is plausible, but neither economic theory or empirical evidence leads one conclusively to this assumption. Omitting the assumed effects of innovation might lower the savings by $5 to $10 million. Some of this savings come from the lower NO_x emission reductions required in 1997 under RECLAIM than under the old AQMP. Thus about $7 million to $13 million of the lower cost comes from requiring lower emission reductions.

The District's estimate of savings assumes that all cost-effective trades that might occur will occur. The District's analysis indicates that about one-quarter of the NO_x reductions below 1994 levels in 1997 will be traded (i.e., about 9 of the 35 tons per day). To the extent that some of these trades do not occur, due to mistrust of the market or because the additional effort may just not seem to be worth the bother, some of the remaining forecasted savings also will not occur. However, the District's model is not able to account for cost savings that might occur *within* facilities. These are the types of "trades" that are most likely to occur in the early years at the largest sources. Thus it is unclear whether, on balance, the estimates of trading are high or low.

Most of the cost savings appear to come from "time shifting," that is, sources scheduling the cheapest emission reductions first, rather than according to the somewhat arbitrary schedule originally imposed by the District. These cost savings are quite likely to actually occur, but again, this is but one of several components that comprise the District's total cost savings estimate of 25 percent.

Administrative burden—The administrative burden for firms complying with the RECLAIM program will also vary. There was some concern early in the program development that monitoring and recordkeeping demands could prove too onerous for some, especially small businesses. (This might be especially problematic in a market for VOCs,

which would include a larger number of small businesses.) Larger facilities, with numerous pollution sources to consider for control, typically have a greater resource base from which to operate and determine the best approach for operating in the market. Little information is available on whether RECLAIM places additional administrative demands on firms beyond those that already exist in the previous regulatory approach.

RECLAIM development and implementation proved a formidable task for District regulators. While no cost estimates were made (or available) prior to the undertaking, it quickly became one of the largest demands on District staff and other resources. The District Finance Division provided some cost data that showed that RECLAIM program development cost $0.9 million in FY 1991-92, $4.7 million in FY 1992-93, and $4.5 million in FY 1993-94. In addition, overtime hours paid for RECLAIM staff were some of the highest in the agency (147). This intensive effort and the associated burden on the District can probably be explained by the uncertainties involved in this program as a first-time major effort of this kind. They were breaking new regulatory ground with nearly every decision that had to be made.

RECLAIM permitting was split into two six-month cycles. Although there are 59 more Cycle 2 facilities than Cycle 1, District staff were able to cut the permitting time down by nearly one month through lessons learned and products created from the first round of permitting—which required 50 staff over a three-month period (147). With additional implementation experience the program costs for the District should decline as more of the resources are moved away from program development and applied to implementation and enforcement.

Fairness—Concerns for fairness in the design of the program are probably best revealed by decisions that were made regarding program participants, initial allocation of emission credits, and emissions reduction requirements. For example, initial plans for RECLAIM included a market for trading of VOCs. This market would have incorporated the largest number of facilities when compared to the much smaller number of sources considered for the NO_x and SO_2 programs. A high percentage of VOC emitters are small businesses, especially paint and finishing businesses. The District planned early to exempt some small VOC emitters—for example, dry cleaning facilities, restaurants, and gas stations—and some large sources, such as fugitive emissions at refineries and sewage treatment plants. This narrowed the list of possible sources from about 13,000 to approximately 2,000 (179). There was some concern that smaller businesses might be at a disadvantage in a market system, but good information on this subject is scarce. Members of the Small Business Coalition participated actively in RECLAIM development, and while concerns about program impacts never fully subsided, it is unclear whether there was a consensus opinion as to whether RECLAIM should be adopted or not.

It is no secret that the biggest firms (including oil companies, some aerospace firms, etc.) supported the RECLAIM concept from the start. Larger firms, typically owning facilities with many emission sources, had the most to gain from the added flexibility that a trading system would allow. The majority of the necessary NO_x and SO_2 reductions required by RECLAIM were already accounted for in previously adopted rules. Committing to additional reductions was an easy trade for gaining the flexibility allowed in the program. In effect, RECLAIM was a rule of relaxation for oil companies and utilities (174). Bringing other firms fully on board and working out the program details to make it fair for all involved was the real task.

One of the most controversial aspects of adopting RECLAIM was deciding the initial allocation of emission credits. The starting RTC allocation was significant for most businesses in that none would want to be penalized by their new emissions cap. One of the primary tenets of the Regula-

tory Flexibility Group (RFG)[5]—a business coalition—was that no business should start off "in the hole," especially since all future reductions would drop from this allocation. There was significant concern that the initial allocation should not only allow for growth beyond recessionary levels of the recent past but should also account for previous application of pollution control equipment.

The District worked for an allocation methodology that was equivalent to adopted rules and the AQMP, and that was fair and equitable to firms. Their view of this meant that attention to fairness required allocation levels necessary to accommodate operating levels. The District finally selected an allocation approach based on "historic use" of each piece of NO_x and SO_2 equipment at a facility and subtracting the emission reductions necessary to comply with adopted rules.

While this method proved favorable to most of the participating firms, environmentalists contend that the initial allocation was too large and that it overcompensated for recessionary emission levels. They believe that the allocation is so high that the District will actually lose some progress made in the late 1980s and that it delays further progress to much later in the program. They believe that the initial allocation allows more pollution than would have been emitted in 1994-95 under the 1991 AQMP, and because of this, RECLAIM does not achieve reductions equivalent to the original plan. In effect, although RECLAIM is designed with an emissions endpoint equal to the AQMP, it does not account (or compensate) for the excess emissions in the early years of the program. Overall, environmentalists claim that RECLAIM is responsible for approximately 40,000 tons of additional emissions in the District (82,117). There is currently a lawsuit pending on this point.

Another fairness issue for the program developers was the rate of emissions reduction that would be required for each firm. Guided by future air quality standards that must be attained, the District had to limit participating facility emissions each year, including a specific reduction rate that would ensure that goals would be met. Initially, every facility was to make reductions at the same rate. It soon became clear that many firms felt this would be unfair, especially those that had already incorporated the best pollution control equipment. After a year of negotiation and remodeling with different proposed reduction rates, it was finally decided that there would have to be different final targets for each facility taking into account each facility's current level of emissions and future control potential. Therefore, some firms have a fairly flat reduction schedule while emission limits for others drop off significantly (228).

VOC RECLAIM was deferred, in part, because the major oil companies realized in the end that they would be forced to make reductions that were not based on any known technologies (174). There was real concern that the reduction would have to be made in cuts to production levels, though the District did not feel that this would be necessary. Also, under the traditional regulatory approach, firms demonstrating best efforts to make reductions could often receive extensions to technology-forcing regulations if they could prove that it was impossible to comply. The loss of this option was considered unfair by the largest firms and they chose to oppose VOC RECLAIM (228). The CARB also continued to have concerns with the program because quantification of VOC emissions was not exact enough for trading.

Environmental equity and justice

Environmental justice concerns were an explicit part of the District's environmental assessment of the RECLAIM program and possible alternatives, including the 1991 AQMP. Localized effects of VOC, NO_x, and SO_2 emissions and their addition-

[5] The Regulatory Flexibility Group is a coalition of businesses involved in RECLAIM development including firms such as Allied Signal Aerospace Co., ARCO, Chevron, Hughes, Mobil Oil, and the Walt Disney Company, among others.

al role as precursors to ozone and particulate matter were modeled and discussed extensively. Possible health impacts were especially contentious in VOC program development because of the potential for toxic emissions in this category and the possibility of contributing to toxic hot spots. The District will likely opt to exclude the most toxic substances (such as benzene, styrene, methylene chloride, and perchloroethylene). Moreover, air toxics will continue to be regulated under other programs that target them specifically.[6] The current delay in the VOC program has allayed, though maybe just temporarily, many fears about localized toxic impacts of trading.

One segment of the opposition to trading on the grounds of uncertain or negative health impacts due to RECLAIM was that of the environmental justice community. Although it was not a well-organized opposition, serious concerns were raised that some neighborhoods, especially low-income neighborhoods, would have worse air pollution than others. While this problem may not necessarily be aggravated by RECLAIM, opting for a trading system was in principle giving consent for some facilities to pollute more than others and forego greater emission reductions than could have been achieved. Although data are still limited in this area, many concerned with environmental justice contend that most polluting facilities are in or near poor and minority neighborhoods. For these groups, the risks associated with uncontrolled emissions are unacceptable.

Further, under RECLAIM, facilities do not need prior approval for trades; thus the opportunity for public participation is diminished. However, any action to install new equipment or increase emissions over the 1994 emissions cap is subject to review, and if the changes are significant, public notice is required. Beginning in 1996, the permitting requirements adopted under the 1990 CAA Amendments will require each whole facility permit to undergo public review and comment prior to being reissued. (This will occur every five years.)

To determine whether the fears of the environmental justice community were founded, the District analyzed whether areas with higher percentages of a given race (white, black, Hispanic, and Asian) experience higher levels of ozone exposure than areas with lower percentages. The District modeled both the correlation today and projections for the future under RECLAIM and the more traditional AQMP that RECLAIM was developed to replace. The study found that in 2000, RECLAIM would be somewhat better than the AQMP alternative, with regard to the distribution of exposures, for blacks, Hispanics, and Asians. RECLAIM would be slightly worse for whites than the AQMP alternative in 2000.

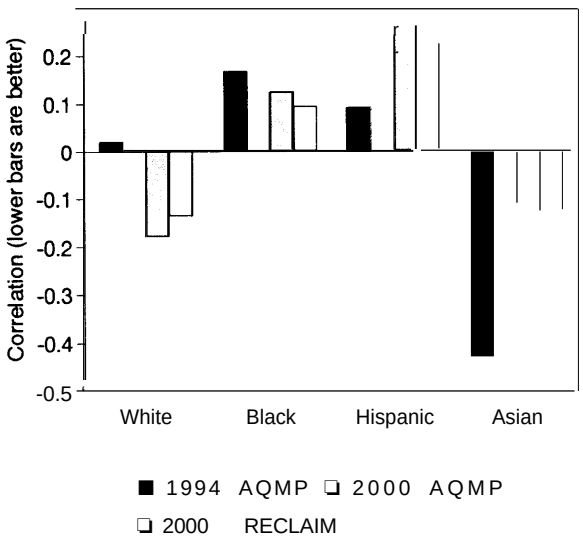
For this study, the measure of ozone exposure was the number of hours per year that people are exposed to ozone concentrations above the standard. In 1994, this was somewhat over 30 hours per year, on average, for all residents of the basin. By 2000, exposure under either plan is forecast to drop to below 20 hours per year. Figure 2-9 displays the relative distribution of exposure today and the forecasts under the two plans in 2000. The black bars show the distribution today. A bar greater than zero, that is, a bar above the line, means that an area with a higher percentage of that race is more likely to have higher ozone exposures than an area with a lower percentage of that race. Thus, in 1994, areas with the higher percentage of blacks were more likely to have higher exposures to ozone than those with lower percentages for blacks. The same goes for areas with higher percentages of Hispanics, but not as pronounced as for blacks. An area with a higher percentage of Asians was more likely to have a *lower* exposure to ozone than an area with a lower percentage of Asians (i.e., the bar is below the line).

[6] Including title III of the 1990 Clean Air Act Amendments and California's Air Toxics "Hot Spots" Act.

Two aspects of the two plans in the year 2000 are of interest. First, compared with each other, the distribution of ozone exposure is slightly more even under RECLAIM than under the more traditional AQMP alternative. Thus, if the modeling of the patterns of trades of emission credits is accurate, the feared aggravation of exposure to ozone in black and Hispanic areas is not likely, or at least not likely to be large. It is still true that there is less certainty about the distribution of ozone under the RECLAIM trading program, but the pattern of trades in this case may slightly favor black and Hispanic areas.

Another result is also striking, however. The changes between years is greater than the change between programs in 2000. Areas with higher percentages of Hispanics are more likely to be living in higher ozone areas in 2000 than they were in 1994. This does *not* mean that Hispanic areas will be exposed to more ozone in 2000 than 1994. As mentioned above, exposure to ozone drops dramatically throughout the basin. But in 2000, high Hispanic areas are more likely to be among the high ozone areas. RECLAIM improves the situation somewhat, but neither program-the more traditional AQMP regulatory program or RECLAIM—addresses the uneven distribution of exposure for Hispanics.

FIGURE 2-9: Correlation of Ozone Exposure and Race



SOURCE: South Coast Air Quality Management District, *RECLAIM: Socioeconomic and Environmental Assessment, Final Report* (III) (Diamond Bar, CA, October 1993).

Assurance of meeting goals

To balance the increased flexibility of the trading program, RECLAIM has required sources to improve emissions monitoring, measuring, and reporting. For larger sources of NO_x and $S0_2$, this means continuous emissions monitors. For smaller sources, this means continuous process monitors or fuel meters.

While industry expressed some concerns about the expense of continuous emissions monitoring for NO_x and $S0_2$, they were still generally willing to compromise in this area---especially since many of the larger sources already were or would be required to use CEMS under the current or proposed District rules subsumed by RECLAIM. A more contentious issue was the frequency of reporting this emissions information.

During the course of the compliance year, facilities are required to periodically report their emissions to the District. At the close of the first three quarters, facilities have a one-month period to certify their emissions for the quarter. At the end of the compliance year, facilities will be required to report their emissions and will be given a two-month reconciliation period to secure or sell any RTCs needed to "balance their emissions books" for the last quarter of the year.

A facility that exceeds its annual emissions allocation will be required to accomplish the reduction the following year and may be subject to monetary penalties. Facility permits may be revised (to include conditions to ensure future compliance) or possibly revoked.

Program-specific provisions to prevent "backsliding''—i.e., emission increases—may be proposed to the District Governing Board based on the findings of the annual or three-year audits to address specific program problems. Such provisions might include restricting trading, pre-ap-

proval of trades, enhanced monitoring, faster reduction rates, implementation of technology-specific emission controls, and increased penalties. In response to concerns that such "potential" backstops were not enough to ensure that RECLAIM would meet environmental goals, the District added provisions requiring reinstatement of rule limits in existing rules within six months of a report to the Board that either emissions or exposure to ozone increased by more than 20 percent above targeted values.

Another facet of assurance in meeting environmental goals under RECLAIM is how the program compares to the 1991 AQMP. Several environmental groups have argued that because the reduction rates for SO_2 and NO_x emissions are slower under RECLAIM, total emissions will actually be higher under RECLAIM. The District disagreed, primarily because RECLAIM sets mass emission limits on facilities, while the AQMP relied on setting emission rates—thus not preventing possible increases in emissions due to expanded work hours or facility expansion.

Many of the most strenuous objections to RECLAIM focused on the VOC trading program. The VOC trading market originally included all sources releasing more than four tons of organic compounds each year. This would have included about 2,000 facilities and about 85 percent of permitted emissions. Essential public services, restaurants, dry cleaners, and gas stations were exempted.

These facilities faced a 5-6 percent reduction cap each year. Fugitive emissions would be included in the facility baseline but the credit for reduction would only be given once standard, replicable methods to estimate emission reductions were developed.

In NO_x and SO_2 RECLAIM, the flexibility of the trading program was balanced by a more stringent monitoring system calling for CEMs for all major sources and continuous process monitors for all other sources. However, because it is so difficult to capture all VOC emissions, District staff felt that the available—and quite expensive—continuous monitors would not accurately reflect the total VOC emissions at a facility.

Instead, VOC monitoring would rely on tracking and reporting programs. VOC emissions would be calculated using flow characteristics of each facilities process, including the effectiveness of control equipment. VOC-containing products would be certified and labeled for VOC content and labeled for tracking. (A variety of tracking systems were proposed, such as bar codes and scanners, scannable forms, "credit cards," and telephone reports.)

Mass balance calculations would also be used (monitoring the amount of VOC product used), and the control equipment would also be monitored to determine effectiveness. District officials could use third-party records such as supplier invoices to check the permittees' reports. Finally, field inspections (checking that VOC content and label agreed and that control equipment was being used) would provide additional verification.

Environmental groups were hesitant from the start of the original VOC RECLAIM program. Monitoring was much more difficult than for NO_x or SO_2, and VOC emissions came from many more sources. Environmental groups were also worried that companies could easily falsify records and that enforcement would be difficult. They suggested phasing in VOC RECLAIM after the effectiveness of the first two trading programs was demonstrated. The District agreed that compliance issues were more complex for VOC trading but argued that it is possible to design transaction management systems—for example, barcoding drums of solvent—to improve emissions tracking and monitoring. In February 1993, however, the District agreed to postpone the VOC trading system.

Under the current plans, monitoring and reporting requirements would be streamlined and rely on monthly reporting of products used. The universe of facilities has been narrowed (to about 1,000) to include only VOC emissions from solvent, coating, and degreasing operations.

Emissions from solvent and coating operations are somewhat easier to quantify than, for example, fugitive emissions from refineries. In addition, better historical records are available for VOC usage, enabling the District to set somewhat less

controversial allocations. The overall VOC reduction rate will be similar to that originally proposed—probably between 5 and 6 percent—but will vary by facility. For example, if a particular facility meets all "command and control" rules and the AQMP doesn't delineate further control code reduction requirements for the industry, a facility's reduction rate may be set at zero.

Facility-Wide Permitting in New Jersey[7]

Few other American states have had to deal with the combination of population density, industrial diversity and concentration, and a legacy of environmental degradation as has New Jersey. One of the state's most innovative initiatives for dealing with these problems has been an ambitious pilot program that links permitting with pollution prevention planning, primarily by moving from source-based permits to a single, facility-wide permit. As of April 1995, New Jersey has issued one final facility-wide permit, has at least two more close to completion, and has selected an additional 15 facility volunteers.

The initiative has two major components: planning and permit integration. Planning—central to achieving the goal of a 50 percent reduction in use, discharge, and generation of hazardous substances—is to be done in two parts. Part I requires each facility to generate essential planning data by identifying all facility processes involving hazardous substances governed by the statute and analyzing how those substances flow through the facility. For Part II, the facility develops a plan that targets processes and sources for prevention efforts by listing available prevention options, analyzes feasibility of the options, indicates those to be implemented, and establishes a set of numeric pollution prevention goals and measures for the next five years. More than 850 facilities are expected to participate in the planning component.

The second component creates a pilot program to link a facility's planning process to the integration of its environmental permits into a single permit. This would be a significant change from current approaches. At present, water permits are typically focused on facility-level releases, air permits on source-level releases, and hazardous waste permits at the process level for waste classification only. An integrated permit focuses on process-by-process information. Required for all three media, process information is drawn directly from the analyses conducted for facilities' pollution prevention plans. A process focus allows both the facility and state officials to examine issues for all media within each process and then integrate those views to create a facility-wide picture of releases and prevention options.

New Jersey's integrated permitting pilot project is best understood in its broader historical and programmatic context. The state for several years has responded to its environmental challenges with ambitious regulatory programs, many of which have served as models emulated by other states or the federal government (148,173). In response to delay and confusion over permit proliferation and fragmentation, the state over the past decade has developed several initiatives to improve permit coordination.

The state created an Office of Permit Information and Assistance in the New Jersey Department of Environmental Protection and Energy (DEPE), which convenes preapplication conferences and provides information. The Office of Business Advocacy in the Department of Commerce and Economic Development set up a one-stop construction permit identification program. Under this program, prospective applicants are asked to complete a form detailing their construction plans. The prospective applicants receive within 15 working days notification from the Office of all state construction permits that they will require, copies of all forms that must be completed, and the offer of a "permit expediter" who, if accepted, is to work on behalf of the proponent. Finally, legisla-

[7] Parts of this section are based on B.G. Rabe, "Integrated Permitting: Experience and Innovation at the State Level," unpublished contractor report prepared for the Office of Technology Assessment, U.S. Congress, Washington, DC, June 1994.

tively mandated deadlines for permit issuance, discussed above, prod the DEPE and related agencies to churn out permit decisions within 90 days of application (8,83).

As is true with the use of such coordination mechanisms nationwide, these efforts are thought to have achieved some acceleration of permit decisions but have demonstrated little if any integrative capacity. In contrast, New Jersey has launched a series of integrative initiatives in recent years, including an ambitious program to link permitting with pollution prevention planning and move from segregated permits to a single, facility-wide permit. Such a step was initially proposed in the New Jersey legislature in 1989 and was approved and signed into law in somewhat modified form in August 1991. The New Jersey Pollution Prevention Act created an Office of Pollution Prevention within the DEPE and gave it authority to oversee both the pollution prevention planning and facility-wide permit processes (272).

How the Program Works

The planning process

Under this legislation, preparation of pollution prevention plans became mandatory for a large number of New Jersey firms. All facilities required to report under the federal community right-to-know program must, in turn, complete pollution prevention plans for the New Jersey Office of Pollution Prevention. More than 850 New Jersey facilities are thus expected to participate, developing plans that examine prevention options for all of the chemicals covered in the federal legislation. Facility-wide permitting was to be conducted on a pilot basis among individual industrial firms which had completed their plans.

The planning process is intended to provide "a source-by-source investigation of pollution prevention opportunities" conducted by each facility (8). The process is divided into two parts, with the first focused on generation of data essential to systematic exploration of prevention options. Firms are expected to identify all processes within a facility that involve hazardous substances specified in the legislation and analyze the way in which those substances flow through the facility. This is followed by identification of each process within the facility that involves hazardous substances and generation of inventory data for each process level. These data are essential to identification of sources that have been targeted for pollution prevention efforts (135).

The second part involves the formal construction of a plan to target processes and sources for pollution prevention. Each targeted process or source must be described and the quantity of nonproduct output (NPO) must be established for each source. NPO is defined as any hazardous substance that does not leave the facility in the form of a product of immediate commercial value or value when further refined elsewhere. NPO per unit of product provides a consistent annual measure of pollution prevention progress.

Once these assessments are completed, all participating facilities must list available pollution prevention options, including possible changes in procedures, technologies, and equipment, for each targeted production process and source. After completion of a feasibility analysis for each available option, the plan is to describe those pollution prevention options deemed technically and economically feasible.

Each facility must identify a series of five-year numeric pollution prevention goals. These include facility-level goals to reduce use and the generation of NPO for each designated hazardous substance as well as process-level goals to reduce the generation of NPO per unit of product for each hazardous substance within each targeted process.

Facilities must also provide an implementation schedule. These schedules are to include an anticipated construction start and completion date for each pollution prevention option (135).

The permit integration process

The legislation also called for creation of a pilot program to link pollution prevention activities with an integrated, facility-wide permit process. The Office of Pollution Prevention (OPP) was given authority to select from 10 to 15 firms and

integrate each firm's many environmental permits and approvals into a single permit covering dozens, or in some cases hundreds, of traditional air, water, hazardous waste, and other permits. The ultimate product is a single facility document containing a summary of central aspects of the permit followed by separate sections, each of which examines the relevant permitting concerns for each production process.

Linking the process-by-process examination of hazardous substance flow completed for the pollution prevention plan to the permitting process allows both the facility and state officials to examine issues for all media within each process and integrate those views to create a facility-wide picture of releases and prevention options. However, the water permit program is currently focused on releases at facility level, the air permit program on releases at source level, and hazardous waste at a process level for waste classification only (136).

The New Jersey approach also allows greater flexibility for firms that want to make operational changes to accommodate new product lines and related adjustments. Under air quality preconstruction regulations, for example, holders of a facility-wide permit have an easier time than traditional permit holders having proposed changes deemed "amendments" rather than "alterations." Consequently, any proposed changes do not need DEPE preapproval as long as they do not increase the permitted concentration or rate of emission of any air contaminant for the production process or entire facility, NPO generation per unit of product, or the concentration or effluent limitations of any pollutant to surface waters (274). Observers of the New Jersey process contend that this flexibility is one of the main benefits to participating firms, in addition to increased ability to address major regulatory problems at a facility and public image enhancement through participation. However, these benefits differ considerably from case to case.

The permit application requires information in a very different form than for a medium-specific permit. Applicants are expected to provide both administrative and technical information on a process-by-process basis, including NPO per unit of product; air releases; discharges to surface water, ground water, and publicly owned treatment works; hazardous waste generation activities; and pollution prevention issues, such as cross-media transfer from operations and viable pollution prevention options developed in the pollution prevention plan. Much of this information can be drawn directly from the completed facility plan.

Once the application is received, the OPP coordinates activities of a Facility-Wide Permit Management Team. This team is to consist of representatives of all New Jersey program areas covered by the proposed permit and a representative of EPA Region II who will serve as a key contact for other federal officials whose input may be needed.

Public involvement procedures will follow the practices called for by the strictest individual permit, allowing for the longest required public comment period and earliest required public hearing. After this public involvement period, a final facility-wide permit is drafted by the permit team in consultation with individual program offices. A final period for internal agency review leads to permit issuance.

Early implementation experience

The DEPE launched its pilot program by deciding to seek only facilities willing to volunteer. Three such facilities were selected in early 1992 and formal agreements between the agency and the firms to work cooperatively on facility-wide permitting were signed in March. Two months later, similar agreements were signed with EPA Region II and agency headquarters. As these three facilities moved through the process, additional volunteers were sought. Twenty-six firms offered to participate and 15 were selected in December 1993.

One final facility-wide permit has been issued, with significant progress on at least two other permits. This experience to date suggests that the facility-wide permit concept is viable.

The issued permit is a for pharmaceutical manufacturing and research firm in Madison operated by Schering-Plough Corporation. This facil-

ity manufactures pharmaceutical products, including capsules, pills, asthma inhalers, ointments, creams, and their packaging, and has approximately 2,000 employees. Under traditional permitting approaches, the facility was required to obtain 897 permits just for air quality alone.

Under the integrated permitting approach, the entire Schering-Plough operation was broken into 31 separate production processes, each with its own section in the integrated permit. The OPP sent a preliminary permit draft to the company for its review in June 1994, and a final facility-wide permit was issued in late 1994. Overall, the process has proven to be more time consuming than anticipated but is generally perceived as both identifying numerous areas for pollution prevention advances and demonstrating the administrative workability of integrated permitting.

The two other initial pilot project selections continue to move through the various stages of the process. In Birmingham, Sybron Chemicals, Inc., provides a somewhat different test, since it is a more moderately sized facility. Nonetheless, the facility has previously been required to obtain more than 60 different permits for air, surface water, and ground water discharges and has encountered serious delays in some permit approvals. In the past, for example, Sybron has had to wait a full year in order to add or change just one air permit. Moreover, it had never before systematically explored the prospects for pollution prevention on a facility-wide basis, making it a good candidate for the pilot program (183). The final pilot case is Fisher Scientific, Inc., located in Fair Lawn, which is a specialty chemical manufacturing facility. After some delays due to changes in company leadership, Fisher completed its plan and submitted it to OPP in June 1994. One permit team has been assembled to work on all three cases, with members from OPP, EPA Region II, and all relevant DEPE programs.

The experience with these three cases was sufficiently encouraging for OPP to pursue the upper boundary of its legislative mandate by selecting 15 additional volunteer facilities. The planning and permitting processes are beginning with all of these facilities, which were selected on the basis of criteria set forth in the legislation. These criteria included facility size, number and types of permits, number of hazardous substances, permit expiration dates, existence of cross-media issues, and types of enforcement issues. The OPP also sought applicants with a strong track record of regulatory cooperation, although this was not part of the formal criteria.

The legislation calls upon the DEPE to issue permits for each of these facilities by August 1995. In March of the following year, the DEPE is required to prepare a report for the governor and legislature that analyzes the facility-wide permit program.

New Jersey's Integrated Permitting and the OTA Criteria

New Jersey's integrated permitting experiment sought to improve a facility's use of pollution prevention approaches and to increase the facility's ability to adapt quickly to new product or process opportunities. The following sections briefly review how the program intends to further these two criteria.

Pollution prevention

The New Jersey program illustrates the potential for linkage of facility-wide pollution prevention planning with integrated permitting. Unlike most states, in which pollution prevention planning operates largely independently of permit decisions, New Jersey blends the two together in an effort to maximize opportunities for pollution prevention. By combining permitting with other aspects of the state's pollution prevention program, such as technical assistance, the state may be offering a package that is appealing to industry and will lead to significant pollution prevention gains.

The state's early experience in combining pollution prevention planning with a facility-wide permit in a small number of cases illustrates some of the potential changes that can ensue. For example, this process led to the discovery by officials of the Schering-Plough pharmaceutical plant of significant amounts of a hazardous substance, 1, 1, 1 Trichloroethane, that were being released into the air.

Review of a process for cleaning equipment used to manufacture asthma inhalers found that it generated fugitive emissions five times greater than levels allowed for the entire facility. The integrated planning and permitting processes found the leaks and devised a delivery system that has virtually eliminated them.

By concentrating at both the facility level and within individual processes, the New Jersey approach generates a more coherent picture of what is transpiring within facility walls and what opportunities for prevention exist. The 897 air quality permits that were formerly required of the pharmaceutical facility were compressed into a single permit that divides the entire facility into 31 separate processes. The overall emissions reduction goals of the pollution prevention plan requirements make clear that the state is serious about achieving major gains. In turn, the integrated process creates an opportunity to make that transformation as easy as possible for the regulated party.

New Jersey officials noted that the experience has also elevated awareness of pollution prevention opportunities among their DEPE colleagues. By participating in an integrated site visit and jointly reviewing draft plans and permits, officials from fairly narrow regulatory backgrounds get what may be their first opportunity to take a broader look at a facility. This allows them to examine the facility's particular environmental problems and target areas where significant gains can be achieved.

Adaptability to change

New Jersey's initial experiences indicate some potential for integrated permits as an adaptable alternative to traditional permitting. The permits incorporate a range of allowable changes that the state agency and facility could anticipate during permit development. Facilities believe that the process-based integrated permit will allow them far greater flexibility to accommodate new product lines and other changes in a speedy enough manner to take advantage of changes in market conditions.

However, the substantial time and resources expended to issue an integrated permit that incorporates individual permits—sometimes hundreds—highlight the potential difficulty of reopening and amending an existing integrated permit. The first integrated permit New Jersey issued took approximately three years to develop and finalize. The state anticipates significantly shorter development periods for future integrated permits. Nonetheless, the potential delay could be a barrier to adaptability, if the state and facility wish to modify a permit because circumstances or technologies have arisen that were not anticipated.

Proposition 65 and the California Air Toxics "Hot Spots" Program

Two information reporting programs in California illustrate the strengths and weaknesses of this instrument with regard to our three "environmental results" criteria: 1) assurance of meeting environmental goals, 2) pollution prevention, and 3) environmental equity and justice.

The Safe Drinking Water and Toxic Enforcement Act, otherwise known as Proposition 65, was adopted in California as an initiative on the ballot in the November 1986 elections (270). The law's primary goal is to lower the risk to human health and the environment associated with exposure to toxic chemicals. It attempts to achieve this goal through the increased availability of information on toxic chemical use and releases as an incentive for industry to remove nonessential carcinogens and reproductive toxins from its products and processes. The law covers both consumer products and facility discharges. It focuses on estimates of risk to human health, rather than the more common, but harder to interpret, reporting of emissions.

Another information-based program in California combines information reporting, risk assessment, and public notification in a law that also works to identify and control public exposure to air toxics. The Air Toxics "Hot Spots" Information and Assessment Act of 1987 established an emissions reporting program to inventory statewide emissions of more than 700 toxic substances

(272). The law further requires identification and assessment of localized risks of air contaminants and provides information to the public about the impact of those emissions on human health.

How the Programs Work

Proposition 65

On the books, Proposition 65 is a fairly simple law, spelled out in two basic steps. First, it requires the governor of California, in consultation with scientific experts, to compile a list of chemicals known to the state to cause cancer or reproductive toxicity. Second, it places two restrictions on these chemicals: 1) businesses should not knowingly and intentionally expose an individual to any one of the listed chemicals without first providing a clear and reasonable warning, and 2) businesses should not discharge any one of those same chemicals into any current or potential source of drinking water.

The law recognizes that at some level the risk posed by these chemicals will be *de minimus.* Thus, no warning is required if the amount of the listed chemical present in ambient environmental exposures, exposures from consumer product use, and discharges into current or future sources of drinking water fall below a level which would pose "no significant risk" for carcinogens (i.e., one excess cancer in 100,000 humans exposed over a 70-year lifetime at that level) and below a 1,000-fold safety factor of the "no observable effect level" (NOEL) for reproductive toxicants.[8]

Currently, the list of chemicals for the purposes of Proposition 65 includes 542 chemicals (392 carcinogens and 150 reproductive toxicants). Of the listed chemicals, 274 have "no significant risk" levels assigned and eight reproductive toxins have the 1,000-fold safety factor of the "no observable effect" level (NOEL) assigned.

Enforcement of Proposition 65 is carried out by the state attorney general, district attorneys, some city attorneys, and private citizens. Proposition 65 requires the plaintiff to demonstrate that a regulated business caused a "knowing and intentional exposure." It is then the responsibility of the business (the defendant) to prove that the extent of the exposure did not exceed the levels allowed by the law.

"Hot Spots"

Each air pollution control district in California implements the "Hot Spots" Act through a four-step process. In the first stage, all permitted facilities were required to prepare and submit an air toxics emissions inventory to the District office. Facility reporting requirements were phased in based on the quantities of other air pollutants they emitted.

The second stage requires District offices to use the emissions inventory data to rank facilities in high, intermediate, and low priority categories to determine the need for risk assessment.[9] Priority is based on a number of factors including the amount of contaminants emitted, relative potency and toxicity of the contaminants, and the proximity of facilities to nearby communities. Once classified, only high priority facilities trigger further program requirements. Designation as a high priority facility, does not necessarily mean that nearby populations are at increased risk from air emissions. Instead, it is an indication that further assessment of the facilities emissions is needed.

In the third step, all high priority facilities are required to prepare health risk assessments to measure the adverse health effects that may result from exposure to a facility's emissions. The California Office of Environmental Hazard Assessment provides risk assessment guidelines that assist facilities in the process. Additional notifica-

[8] Note that: 1) Proposition 65 does not apply to businesses employing fewer than 10 employees; 2) the law does not apply to government agencies; and 3) the law does not apply to drinking water utilities.

[9] As defined by the Air Toxics "Hot Spots" Act, a risk assessment includes a "comprehensive analysis of hazardous substances into the environment, the potential for human exposure, and a quantitative assessment of both individual and population-wide health risks associated with those levels of exposure."

tion and risk reduction requirements vary with the level of risk assigned to each facility. In the final stage, facilities presenting a significant health risk are responsible for notifying exposed individuals of the results of the health risk assessments through direct mail or a public hearing.

The law further requires public access to all emissions data and health risk assessments that are currently available through the state-managed Air Toxics Emission Data system. In addition, each of the air pollution control districts prepare annual reports summarizing the health risk assessment program, ranks facilities according to cancer risk posed, identifies facilities posing noncancer health risks, and describes the status of control measures.

Proposition 65 and "Hot Spots" and the OTA Criteria

A key question about information reporting programs is whether or not they can be as effective as more traditional approaches in achieving environmental results. Thus, in this case study, we focus on the following OTA criteria: 1) assurance of meeting environmental goals; 2) pollution prevention; and 3) environmental equity and justice.

Assurance of meeting goals

The primary goal of Proposition 65, as stated in the legislation, is to lower the risk associated with human and environmental exposure to toxic chemicals. To accomplish this, the state defines a level of "acceptable risk" for the potential of cancer or reproductive disorders for state-listed substances. By requiring a warning when "acceptable risk" thresholds are surpassed, the law creates an incentive to avoid the need to warn by lowering or eliminating the risk of exposure.

Setting levels of "acceptable risk" assumes that risk can be reasonably accurately estimated—a particularly difficult and contentious activity for government agencies and regulated entities. In the case of Proposition 65, the absence of risk levels does not halt the implementation process. Instead, a listed chemical in any quantity is considered unacceptable at any level (requiring clear and reasonable warning) unless proven otherwise. This aspect is referred to as a shift in the "burden of proof" from the regulator to the regulated and is often credited with the fact that many more *de minimus* risk levels have been established for specific chemicals than were accomplished in 12 years of TSCA (157). Therefore, although Proposition 65 includes risk-based goals, assessments of actual risks by government officials are not needed in order to protect against harm due to listed chemicals.

Proposition 65 is likely to meet its environmental health goals in at least some instances. Again, the law requires a warning if risks exceed what is considered an unacceptable level. The potential for negative public perception of the offending firm or consumer product may inspire changes that reduce pollution associated with production or product reformulation, thereby reducing risks from exposure. Thus, though the public cannot be assured that the law's environmental health goal will be met in *all* cases, it is likely to be reached in *some* cases.

Proposition 65, however, may be less successful at assuring the public that environmental goals "have been met." This is because there is no centralized reporting of actions taken. The state does not collect basic information, such as the number of or reasons for posting or removing warnings or labels; nor does it monitor for violations to the law. Most evidence of pollution prevention activities under Proposition 65 is gathered indirectly through letters from manufacturers to distributors concerning reformulations of products or chemical substitutions, or from enforcement actions (often involving reformulations of products), indicating that some level of toxics use reduction does occur. However, since businesses are not required to provide any information about their activities (125), the extent of risk reduction due to the law cannot be adequately estimated.

Monitoring and enforcement are critical for assuring the public that environmental goals have been met. In the case of Proposition 65, violations can only be identified through its overlap with other environmental laws that require some reporting of toxic emissions (e.g., California's Air

Toxics "Hot Spots" program and the national Toxics Release Inventory). For consumer products, contents not regulated by the Consumer Product Safety Commission or the Food and Drug Administration must be traced to the production process. Since this information is not widely known outside the facility, enforcement opportunities are limited.

One attempt to improve enforcement of the law is the citizen suit provision, including the "bounty hunter" allowance that awards citizens bringing successful enforcement actions 25 percent of the total fines collected. Violations of Proposition 65 carry civil penalties that allow for fines at a maximum of $2,500 per day for each violation. In theory, by allowing citizens to keep part of the fines assessed through enforcement actions, more help from the general public will be enlisted.

The "Hot Spots" program is particularly instructive from the perspective of "assurance of meeting environmental goals." Similar to Proposition 65 in some ways, "Hot Spots" focuses on risk associated with toxic emissions and, in cases of unacceptable risk levels, provides for public notification. However, the law goes further by requiring facilities to report toxic air emissions both to the state and to exposed individuals through direct mail or a public hearing. Equipped with emissions data records, the state is able to analyze changes over time in order to better evaluate the impact of the law. And with emissions data, others can check whether the law's risk threshold is exceeded. As with Proposition 65, there is little assurance of knowing in advance that environmental goals *will be* met. However, compared to Proposition 65, the "Hot Spots" emissions inventory provides a significant advantage in determining if environmental goals *have been* met."

Thus, the "Hot Spots" program, as a pure information program, did not provide the desired level of assurance that the environmental goals will be met. Concern over the lack of "teeth" in the program resulted in statutory amendments to the act in 1992 requiring all significant risk facilities to reduce the identified risk below the level of significance. Within six months of designation, facilities must submit a risk management plan that reduces the associated risk within five years.

Pollution prevention

Clearly, one approach to meeting the Proposition 65 goal of reducing risks associated with toxic chemical exposure is to eliminate or reduce the need for the chemicals from the start. In analyzing the link between policy instruments and the promotion of pollution prevention behavior, it is important to consider two important aspects: 1) whether the tool in some way gives an advantage to prevention, and 2) whether the tool encourages organizational learning about prevention. The second aspect attempts to encourage pollution prevention indirectly by changing a firm's culture so that decisionmakers and employees will routinely incorporate pollution prevention practices. The effectiveness of Proposition 65 for pollution prevention is best understood by considering the different impacts on ambient environmental exposures (including facility discharges and workplace exposures) and consumer products.

In the event that exposures surpass allowable risk levels, firms have the option to provide a "clear and reasonable warning,"[10] or reduce or eliminate the toxic chemical from the production process or the facility emission. Proposition 65 works to encourage firms to lower the risk associated with the listed chemical so as to not have to comply with the warning provision.

However, a firm does not have to use pollution prevention activities to reduce or eliminate a toxic chemical. In the case of ambient environmental exposures, Proposition 65's ability to promote pollution prevention is probably neutral—neither encouraging or discouraging pollution prevention. A firm may choose additional pollution control, rather than source reduction, and still avoid a

[10] This does not apply to toxic discharges to water which are strictly prohibited at levels greater than the "no significant risk" or 1/1000 NOEL.

warning. Changes made to the listed chemicals through pollution prevention is the hope, but not necessarily the reality.

Proposition 65 may indirectly promote pollution prevention through the educational role it plays, but this too is unclear. One impact on the regulated community has been an increase in environmental auditing efforts in order to determine compliance with the law. A survey conducted by the California Environmental Protection Agency in 1992 shows that 31 of the 55 respondents did perform audits targeted for Proposition 65 listed chemicals (27). Businesses are concerned with identifying where in their production processes listed chemicals are used and in doing so may make decisions to incorporate pollution prevention practices in order to lower the risks from exposures. Proposition 65 does provide incentives for increased awareness of toxic chemical use, but how much this actually translates into pollution prevention activities is unknown.

However, Proposition 65 does provide a direct incentive for using pollution prevention to reduce risks associated with toxic chemical exposure from consumer products. The primary method to reduce these risks is to eliminate listed chemicals from consumer products whenever possible. Otherwise, the manufacturer must place a warning on the product label if risks associated with its use surpass those allowed by the law. Presumably, some consumers will be discouraged from buying a product carrying a warning label if alternatives are available. Once listed chemicals are removed from the product formulation, reducing the risk to legal levels, the manufacturer may remove the warning label.

A related aspect concerning pollution prevention under Proposition 65 is the use of enforcement actions to force changes in polluting behavior. Though enforcement actions have been relatively few to date, many settlements negotiated thus far have required pollution prevention efforts by the violator. Some settlements have required reformulation of consumer products, for example, one that led to reformulation of liquid correction fluids (28).

Arriving at a clear picture of pollution prevention under Proposition 65 is complicated due to: 1) the lack of baseline information about toxic chemical use; 2) the absence of mandatory reporting of compliance activities; and 3) the overlap with other environmental laws that also affect polluting behavior. Ultimately, while both direct and indirect incentives for pollution prevention exist in theory, the actual level of prevention is unknown.

Environmental equity and justice

Although Proposition 65 was enacted in 1986 primarily as a result of general concerns about public access to information about toxic chemicals in the environment, it has some unique qualities that make it interesting from the perspective of environmental equity and justice. One important feature of any information reporting program is the *nature* of the available information. Depending on the purpose, information may exist in many different forms, including raw data about polluting activities such as that found in the Toxics Release Inventory. Through its warning provision, Proposition 65 brings a different type of information to the public.

Rather than focus on quantities of pollutants, Proposition 65 makes available information about the risk associated with products and activities of regulated entities. The warning sign or label stating the presence of toxic chemicals known to the state to cause cancer or reproductive disorders needs little further interpretation. The hard part of determining whether exposures to the product or emission are hazardous to human health or the environment has been previously determined by another party—those responsible for the exposure.

It is, of course, helpful to interested individuals to have immediate access to information about a potential problem associated with the presence of a toxic chemical. However, even with this new level of risk-based information, individuals typically have little ability to make sense of the risks associated with multiple or synergistic impacts of

toxic chemical exposure. In addition, there is no way to determine whether the level of risk is only slightly above the warning threshold, or very much above it. This limitation, while not unique to Proposition 65, diminishes the value of the information for certain communities that may be more heavily affected by ambient environmental exposures to toxics.

Although the risk-based warning provision does not provide a complete picture of the hazards from toxic exposures, the information is immediately accessible, thus removing at least some of the hurdles facing people who would like to become more involved. In theory, increased information about risks from nearby facilities or from consumer products might motivate action on the part of some—including regulators—to work for change, such as pursuing new legislation or additional regulations (e.g., toxics use reduction laws and special air toxics programs) (70). In the marketplace, the additional information about toxic chemicals may change consumer purchases, favoring products without warning labels over those that carry the state-required warning. The advantage of increased awareness of the presence of toxics provides an added opportunity for all communities to work toward greater protection from environmental and human health risks.

While Proposition 65 does provide a mechanism for increasing public awareness of risk, it does little to insure that all communities will receive the same level of protection from toxic chemical exposures. The built-in incentives to reduce potential toxic exposures rather than manage negative public opinion due to warnings may prove beneficial, but without data on actual reductions assessing the gains made in specific communities will be difficult. In addition, it is unclear whether the additional information gained through Proposition 65 is enough to engage effective public participation, especially in the absence of institutional support for citizen lawsuits. Thus, information reporting about environmental risks may be inadequate for addressing risk concerns in some communities.

Proposition 65 shifts the burden of proof of risk due to toxic exposures from the regulators and the public back to the businesses. To avoid having to post warnings, businesses must re-examine their processes or products for risks associated with the use of toxic substances. Businesses must also quantify the risks associated with listed chemicals and show that they fall below the *de minimus* level or warn instead. Proving that an exposure or emission poses a significant risk is not the responsibility of the citizen. In addition, the bounty hunter provision supports citizens' efforts to protect their communities by making available compensation for pursuing enforcement actions when violations are suspected. Such compensation may be particularly important in low-income communities.

Massachusetts Office of Technical Assistance (MassOTA)

The Massachusetts Office of Technical Assistance (MassOTA) is one of the nation's largest technical assistance programs for promoting pollution prevention, although there are other well-known programs—in North Carolina and Minnesota—that have been operating longer. MassOTA was created in 1989 by the state's Toxics Use Reduction Act (TURA), one of the foremost pollution prevention statutes in the country (172). TURA has the following goals:

- to reduce statewide generation of toxic wastes by 50 percent by 1997;
- to establish toxics use reduction as the preferred means for achieving compliance with any federal or state law or regulation;[11]
- to enhance and strengthen the enforcement of existing environmental laws and regulations; and

[11] Toxics use reduction is defined in the Act 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 byproducts per unit of product . . . without shifting risks to the health of workers, consumers, or the environment."

- to "sustain, safeguard and promote" the competitive advantage of Massachusetts business, while advancing innovation.

The Act established a Council on Toxics Use Reduction and an external Advisory Board on Toxics Use Reduction in the state's Executive Office of Environmental Affairs (EOEA) to advise and coordinate the toxics use reduction activities of three agencies created:

- the Bureau of Waste Prevention (BWP), within the Department of Environmental Protection (DEP) to monitor and enforce compliance;
- the Toxics Use Reduction Institute (TURI), located at the University of Massachusetts-Lowell to support industry efforts through research and development of alternatives and to educate and train students, especially Toxics Use Reduction Planners who certify facility plans; and
- the Office of Technical Assistance (MassOTA), incorporating the former Office of Safe Waste Management in DEP and its technical assistance functions.

The Massachusetts TURA is considered to be the most comprehensive and stringent compared to those in similar states (185). It requires qualifying facilities or "large-quantity users"[12] to report annually on toxics use, both total amounts and a "byproduct reduction index" based on changes in use per unit of production. Users also must prepare two- and five-year facility-wide reduction plans, submit summaries of these plans to DEP, and update the plans every two years.

After reviewing the data submitted, DEP must provide the legislature with an estimate of whether the state will meet the reduction targets. If necessary to meet the targets, DEP has the authority to set performance standards by user segments. These plans can also be used by the Council to select "priority user segments" for special attention, including referral to MassOTA for technical assistance.

What MassOTA Does

Under TURA, MassOTA is responsible for providing technical assistance to toxics users in the state. It offers confidential onsite assessments, conferences and workshops, financial analyses, and written information on toxics use reduction techniques and technologies. Funded out of fees from facilities subject to TURA, MassOTA now has over 30 staff members and an annual budget of over $4.1 million (139). The average size nationally for technical assistance programs engaged in pollution prevention efforts is about four or five staff members (197).

TURA requires MassOTA to assist *all* toxics users in Massachusetts, including small quantity users not subject to TURA reporting and planning requirements. Thus, MassOTA's client base includes all types and sizes of manufacturing firms, as well as nonbusiness organizations and others such as schools, government agencies, hospitals, and residents.

TURA does require MassOTA to give priority to some types of users, especially those referred by DEP for compliance problems. However, TURA prohibits MassOTA from disclosing to the DEP firm information it obtains while providing technical assistance, in part to encourage trust between MassOTA and firms needing assistance.

MassOTA was also required to set up an outreach program to increase compliance with TURA. The agency, with TURI and DEP, sponsored a series of workshops on technical assistance, including three for selected industry sectors, between 1990 and 1994, reaching 133 facilities (or 21 percent of TURA filers). Overall, MassOTA estimates that it has reached about half of the 630 facilities required to report under TURA.

MassOTA has also made onsite visits to about 400 companies out of the 10,020 hazardous waste generators operating in Massachusetts. Five teams of three engineers respond to requests for

[12] Large quantity users exceed the facility threshold (25,000 lbs/yr) for use, manufacture, or processing of a toxic substance. Toxic substances are those defined by CERCLA.

technical and compliance assistance. Based on a site visit by one or two team members to assess a firm's manufacturing processes and identify existing or potential environmental problems, MassOTA staff prepare a report suggesting opportunities for reducing toxics use and additional solutions, including estimates of costs. This type of service, requiring about nine weeks to complete, is normally provided on a "first come, first served" basis, although the agency can give priorities to others if necessary. For example, firms that are TURA filers or DEP referrals may get preference.

MassOTA has not completed a systematic evaluation of its services. However, the agency did fund an independent evaluation of the Central Massachusetts Pollution Prevention Project (1989 to 1992), a technical assistance program focused on metal-intensive industries and jointly funded by EPA's Office of Pollution Prevention, MassOTA, and DEP. The objectives of the project were to:

1. expand the existing technical assistance program;
2. coordinate activities with DEP and local sewage treatment plants;
3. develop a financial feasibility model to enable company managers to determine the cost-effectiveness of pollution prevention options; and
4. share information and coordinate with other technical assistance programs in New England.

MassOTA contracted for an evaluation at the end of the project that compared the performance of the project's target group of 62 firms to the control group of 48 firms not included in the project. The evaluation reported three major conclusions:

- *Firms who got technical assistance services were more likely to reduce use of toxics.* Of the 110 firms included in the evaluation, about half (51 percent) reported reducing their use of toxics. Twenty-seven (87 percent) of the 31 firms using MassOTA services reduced toxics use, while only 26 (or 33 percent) of the remaining 79 firms that did not receive technical assistance services reported doing so. This outcome may reflect the fact that firms contacting and using these services are somewhat predisposed to making changes.
- *The amount of reductions was significant and affected all media.* Twenty firms in the project with sufficient data to evaluate had overall reductions of about 75 percent of all TURA listed substances.
- *Cost savings to the firms were also significant and considerably more than the state's costs of operating the project.* Although MassOTA could document data from only seven firms, their average cost savings from toxics use reduction was about $35,000 per company per year.[13] Savings from these seven firms alone—$250,000 per year—were greater than the cost of the Central Mass Project of $174,000 per year. Additional savings from the other 13 firms in the project that documented toxics use reduction would likely increase this benefit/cost ratio considerably.

MassOTA and the OTA Criteria

Of the seven criteria used in this OTA study on policy instruments, two are highlighted in this case study on technical assistance: 1) adaptability and 2) technology innovation. One other, pollution prevention, is relevant because MassOTA was established to provide assistance with toxics use reduction, a prevention strategy. But the reality is that, while TURA issues are given priority, MassOTA services are not exclusively devoted to them.[14]

An unknown percentage of time spent by MassOTA staff providing crisis assistance, helping a

[13] While firms rely on estimated cost-savings information to approve a project, they apparently do not always document their actual savings record after implementation is completed.

[14] This is true of many pollution prevention technical assistance programs. U.S. Congress, General Accounting Office, *Pollution Prevention: EPA Should Reexamine the Objectives and Sustainability of State Programs*, GAO/PEMD-94-8 (Washington, DC: January 1994).

regulated entity solve a particular enforcement or compliance problem. The outcome may or may not be toxics use reduction. Often, this assistance is considered a way to "get a foot in the door" to start the development of a relationship with a firm. The hope is that at a later date the firm will become more receptive to pollution prevention. There is anecdotal evidence to suggest that this conversion does happen, but how frequently or quickly is unknown.

Adaptability

One reason for choosing instruments with less direct control is that they can be relatively easily adapted to incorporate new information and approaches for solving environmental problems. MassOTA, as a service unit rather than a regulatory agency, can be oriented toward understanding the changing needs of its clients and learning from its interactions with a range of facility personnel across the state. Another key reason for using this instrument is that those firms needing assistance can seek it, while those able to solve problems independently are free to do so.

Like most technical assistance programs, MassOTA is a service organization that usually works with its clients or firms on a one-on-one basis. Even without formal feedback and evaluation, this continual contact gives MassOTA staff a sense of the changing needs of its clients. And, while MassOTA's broad responsibilities are statutory, it has the authority to change its methods of service delivery and improve the quality of information it provides on a continuing basis.

The lack of regulatory power and the prohibition on disclosing firm information to DEP could help MassOTA gain the trust of the business community. The implied threat of future performance standards under TURA, should targets not be met, may also encourage some firms to use the services.

MassOTA explains the dynamics of technical assistance in the following way: "Pollution prevention is a rapidly changing field and [Mass]OTA must adjust its services as new technology evolves, the business climate changes, and regulations at all levels of government affect the production choices of industry (139)."

Though changing environmental regulations can be problems for regulated entities, they are opportunities for MassOTA. The Oregon Department of Environmental Quality concluded that by targeting "windows of opportunity" within the regulatory system—that is, when firms are required to make changes—firms may be more open to new ideas, especially when economic savings can be projected (141). Such an opportunity was exploited by MassOTA recently by sending a letter to all facilities on DEP's air regulatory database informing them that hexane was about to be added to the TRI list and offering technical assistance services.

MassOTA's efforts to make its services more effective for clients can be seen in its revisions in staffing and its site-visit consultation process following early experiences through the Central Mass Project. For example, MassOTA ended its experiments using student interns and volunteer consultants in favor of using permanent, professional staff. It also abandoned the use of lengthy, written site-visit reports in favor of short, three-page written follow-up reports outlining specific solutions. Other changes included the addition of a financial analysis process for client firms and a software system for tracking internal progress.

Technology innovation and diffusion

The primary purpose of MassOTA is to diffuse known technologies among industries in the state and to help firms make needed innovations to existing technologies to fit their particular needs. By focusing its efforts on small firms with less capability to innovate or adopt technologies on their own, MassOTA is following the recommendations of many experts regarding the most effective use of technical assistance programs. In addition, by creating direct links among experts in various industries and in government or research institutions through onsite visits, seminars, and workshops, MassOTA has attempted to keep both formal and tacit knowledge at state-of-the-art levels.

Staff members keep up to date on new techniques and technologies and, as experts in particular sectors, serve as "in-house" consultants to one another. The organization offers periodic "technology transfer days" during which technical staff more formally exchange technical information among themselves. During these sessions vendors often present their products, offering staff an opportunity to learn, critique, and evaluate.

At the same time that they are delivering services, MassOTA staff often learn from the firm as well, collecting and eventually diffusing technical information across the firms that they serve. This diffusion can be somewhat constrained by confidentiality rules. The information in onsite reports written by MassOTA is available only to the firm involved. However, general ideas resulting from its work with a firm can be transferred to others. Case studies, based on onsite work and written in cooperation with the subject firm, are published by MassOTA and disseminated as a way to promote reduction of toxics use.

Most of MassOTA's work involves diffusion of known technology among Massachusetts' industry. Since the state's industry base is generally mature, MassOTA's director classifies its needs as "adaptations of existing technology," labeling these innovative in the sense that they often require incremental changes in the technology to fit a use not previously identified. MassOTA does not seek a major role as a stimulator of new technology development by either regulated entities or the environment industry.

The technological expertise of MassOTA is embodied in its staff, who come primarily from industry and are knowledgeable about manufacturing processes. Diffusion occurs from staff to Massachusetts' industry through its on-site and other work directly with clients, written products such as case study fact sheets, and workshops. The staff are organized in teams on the basis of geography rather than by industry sector.

The Toxics Use Reduction Institute (TURI) at the University of Massachusetts-Lowell is responsible for supporting MassOTA efforts through technology research and development (R&D). This institutional and geographic separation of R&D capacity from outreach capacity stands in contrast to the model experts agree is most effective—physically linking the R&D and outreach staff to improve interaction and problem solving. The directors of TURI and MassOTA have made staff coordination and information sharing a priority in order to overcome this potential barrier to effectiveness.

Although not all states fund the R&D function, some that do have linked it more closely to the technical assistance service unit. For instance, the Illinois Hazardous Waste Research and Information Center (a division of the Department of Energy and Natural Resources) offers onsite pollution prevention technical assistance and has an R&D budget (about $800,000 of an annual $2 million budget). Some other states have small grant programs for technology development.