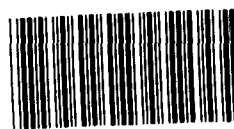
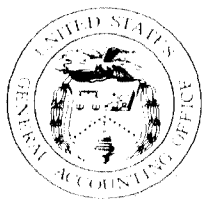


June 1991

ENVIRONMENTAL PROTECTION

Meeting Public Expectations With Limited Resources



144172



United States
General Accounting Office
Washington, D.C. 20548

**Comptroller General
of the United States**

B-242813

June 18, 1991

To the President of the Senate and the
Speaker of the House of Representatives

Recognizing the constraints that limited public and private sector resources place on the nation's ability to meet high public expectations for environmental protection, we examined a number of approaches that the Environmental Protection Agency (EPA) and the Congress can take to make environmental programs more cost-effective. This report urges greater emphasis on setting budget priorities on the basis of health and environmental risks; measuring environmental outcomes of EPA programs; using market incentives, pollution prevention, and other nonregulatory approaches to control pollution; and addressing the environmental financing needs of state and local governments.

We are sending copies of this report to the Administrator of the Environmental Protection Agency, the Director of the Office of Management and Budget, interested congressional committees and subcommittees, and individual Members of Congress.

This work was performed under the direction of Richard L. Hembra, Director of Environmental Protection Issues, who may be reached at (202) 275-6111. Other major contributors are listed in appendix III.

A handwritten signature in cursive script that reads 'Charles A. Bowsher'.

Charles A. Bowsher
Comptroller General
of the United States

Executive Summary

Purpose

Twenty years after the first Earth Day, public commitment to protecting the environment remains high. In a recent New York Times survey, for example, 74 percent of those polled believed that protecting the environment is so important that improvements must be made regardless of cost. Yet clearly the federal government, with a budget deficit estimated at nearly \$300 billion for fiscal year 1991, will be sharply constrained by costs in its ability to address the nation's multibillion-dollar environmental needs. State and local governments also face fiscal troubles, and industry's environmental costs continue to grow.

Drawing on past GAO work and a symposium held in June 1990, as well as analyses prepared by the Environmental Protection Agency (EPA) and others, this report discusses ways in which the federal government can achieve environmental goals more efficiently and effectively.

Background

Despite improvements, numerous environmental problems—indoor air pollution and global warming, for example—remain. This is not for lack of interest or investment. Over the last 20 years, the United States (industry and government) has spent close to \$1 trillion on pollution control. EPA projects that annual spending on pollution control, roughly \$115 billion now, will grow to \$160 billion by 2000.

For the economy as a whole, these expenditures need to yield maximum returns on investment. This holds especially true for federal programs because, historically, funding has not kept pace with the increase in environmental programs. Despite a growth in program responsibilities during the 1980s, EPA's operating budget—which covers all programs other than grants for Superfund, the construction of sewage treatment plants, and the cleanup of leaking underground storage tanks—fell from \$1.7 billion in 1979 to \$1.0 billion in 1983, and only rose back up to \$1.7 billion again in 1991 (in constant 1982 dollars).

Results in Brief

Several changes to current policies and program management could better enable the nation to achieve environmental goals with limited resources:

- Federal budget priorities should reflect an understanding of relative risks to the environment and public health, as well as the feasibility and cost-effectiveness of various approaches to reduce these risks, rather than relying so heavily on public perceptions of risk.

-
- Measuring changes in environmental conditions, rather than levels of regulatory activities, would provide EPA with a more meaningful indicator of the effectiveness of its environmental protection efforts.
 - An environmental control strategy that combines traditional regulatory approaches with pollution prevention and market incentives could be less costly to the economy as well as more effective in controlling pollution.
 - The federal government needs to better understand the financial needs of small communities trying to comply with federal environmental requirements.
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Principal Findings

Setting Priorities

According to a recent report of EPA's Science Advisory Board, a group of eminent scientists and other experts, EPA's funding priorities are more closely aligned with public opinion about health and environmental risks than with scientific assessments. The report reviewed the results of an earlier EPA study in which a group of agency officials concluded that many environmental problems it considered to be of relatively low risk, such as contamination from hazardous waste sites, were receiving extensive public attention and federal resources, while problems the group judged to be of greater risk, such as indoor air pollution and pesticides, were receiving far less attention and resources.

This disparity between risk and priorities also stems from EPA's statutory authority, which is derived from a dozen or so environmental statutes, each with its own, and often different, philosophies and standards. As a result, EPA has little flexibility to base agencywide priorities on an assessment of risk across a spectrum of environmental problems, taking into account also the cost and feasibility of various approaches. In testimony on creating a Cabinet department for the environment, GAO stated that a unified environmental statute might make it easier to set priorities and allocate resources in response to an evolving understanding of environmental problems.

Measuring Progress and Program Effectiveness

Measuring changes in environmental conditions is necessary to assess the effectiveness of programs and make decisions about resource allocations. Instead of looking at these outcomes, however, EPA has generally used activity-based indicators, such as the numbers of regulations

issued, as measures of program effectiveness. Partly because of funding constraints, the agency has not been able to fully monitor environmental conditions and has found it difficult to develop environmental indicators. While EPA has developed additional indicators that can be linked to program objectives, GAO has testified before the Congress that the agency's efforts might receive the priority they merit if there were a central location within EPA for environmental data.

Using Nonregulatory Approaches to Pollution Control

While the traditional approach to pollution control—which requires polluters to adhere to certain performance or technology standards—has helped to control pollution from large, stationary sources, such as factories and power plants, it may be less effective and more costly than alternative approaches, such as market-based incentives and pollution prevention strategies.

Market-based incentives—which include taxes on pollution, trading in pollutant emission “rights,” and public disclosure of polluters’ emissions—all give polluters a financial reason to reduce pollution without specifying how to do so. Pollution prevention, which involves eliminating or reducing pollution at its source rather than trying to contain or treat it after it has been generated, has already been successfully adopted by some companies, which have realized cost savings as well. With the forthcoming reauthorization of a number of major environmental statutes, EPA and the Congress will have several opportunities over the next few years to integrate these and other types of nonregulatory approaches with the traditional regulatory system.

Addressing Local Financing Needs

In recent years, the responsibility for financing environmental projects has been shifting from federal to state and local governments. EPA projects that by the year 2000, local government costs will increase from \$19 billion a year to over \$32 billion (in 1986 dollars) in order to meet new federal standards for drinking water and wastewater treatment, among others. Some small communities of less than 2,500 people may find these new costs especially burdensome, in part because they are less able to expand financial obligations. Although EPA has been examining nonfederal funding mechanisms—such as special taxes, bonds, and user fees—in an attempt to assist state and local governments, the agency recognizes that its efforts are limited and that other federal agencies can play an important role—the Department of Treasury, in terms of tax policy, for example, and the Small Business Administration.

If federal agencies also better understood the needs of small communities that make it difficult for them to meet federal environmental requirements, the government might be better able to target its assistance.

Recommendations to the Administrator of EPA

While recognizing that EPA has already begun to address many of the problems identified here, GAO believes that the agency has to move beyond these measures to deal more effectively with environmental problems. In particular, GAO recommends that the EPA Administrator (1) work with the Congress to identify opportunities to shift resources from problems of less severe risk to problems whose risks are greater; (2) initiate activities to educate the public about relative environmental risks; (3) develop legislative proposals, in conjunction with the forthcoming reauthorization of major environmental statutes, that would supplement the current regulatory structure with pollution prevention and market-based incentives; and (4) identify and report to the Congress on the funding shortfalls that are expected to face certain localities, and alternative forms of assistance for these communities.

Matters for Congressional Consideration

In authorizing and appropriating funds, the Congress should take into account EPA's efforts to reorder budget priorities so that they incorporate the concept of relative risks to human health and the environment, including the costs and feasibility of reducing these risks.

As the 102nd Congress takes up legislation to create a Cabinet department for the environment, it may also wish to consider creating (1) a commission to study the desirability of a unified environmental statute and (2) a center for environmental information to help in the collection and application of data on environmental conditions and trends.

Agency Comments

GAO symposium participants as well as responsible EPA program officials reviewed a draft of this report and generally agreed with its contents. Their suggestions have been incorporated where appropriate.

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Abbreviations

CRS	Congressional Research Service
EPA	Environmental Protection Agency
NGA	National Governors' Association
RCED	Resources, Community, and Economic Development Division
SAB	Science Advisory Board

Introduction

Perhaps more than at any time in our history, Americans have come to expect that government will act rapidly to erase the environmental mistakes of the past and to prevent future environmental problems. Over the last 20 years, the American public, through federal environmental legislation, has set formidable objectives to clean up the nation's air and waterways, protect drinking water supplies, and control the production and use of pesticides and other toxic chemicals. Public expectations for environmental protection remain high even as additional problems—acid rain and global climate change, for example—are being identified.

Responding to these expectations has been, and will continue to be, a costly endeavor. Since the Environmental Protection Agency (EPA) was established in 1970, the United States (the private sector, the federal government, states, and localities) has spent approximately \$1 trillion on the direct costs of implementing measures to control pollution and comply with environmental regulations. Annual environmental expenditures, in 1986 dollars, grew from \$26 billion in 1972 to \$85 billion in 1987, according to EPA.¹ In current dollars, costs reached \$115 billion in 1990, and EPA estimates that by the year 2000, pollution control costs for environmental programs meeting current legislative requirements will reach nearly \$160 billion a year, or about 2.8 percent of the gross national product.

Opinion polls indicate that the American public may be willing to pay even more than it does now for environmental protection. For example, according to a New York Times opinion poll conducted in April 1990, 74 percent of those polled agreed that “protecting the environment is so important that requirements and standards cannot be too high, and continuing environmental improvements must be made regardless of cost.”²

However, the federal budget deficit, estimated at almost \$300 billion for fiscal year 1991, sharply constrains the government's ability to adequately address all national problems, including those posed by the condition of the environment. The amount of money that the private sector

¹All costs in this report are presented in 1986 dollars and are taken from EPA's report *Environmental Investments: The Cost of a Clean Environment* (Nov. 1990) unless otherwise noted. The figures cited here are projections of the annualized costs to the private sector (including households) and state, local, and federal governments of full compliance with federal statutes, including capital, operating, and administration costs. Capital costs are annualized at 7 percent.

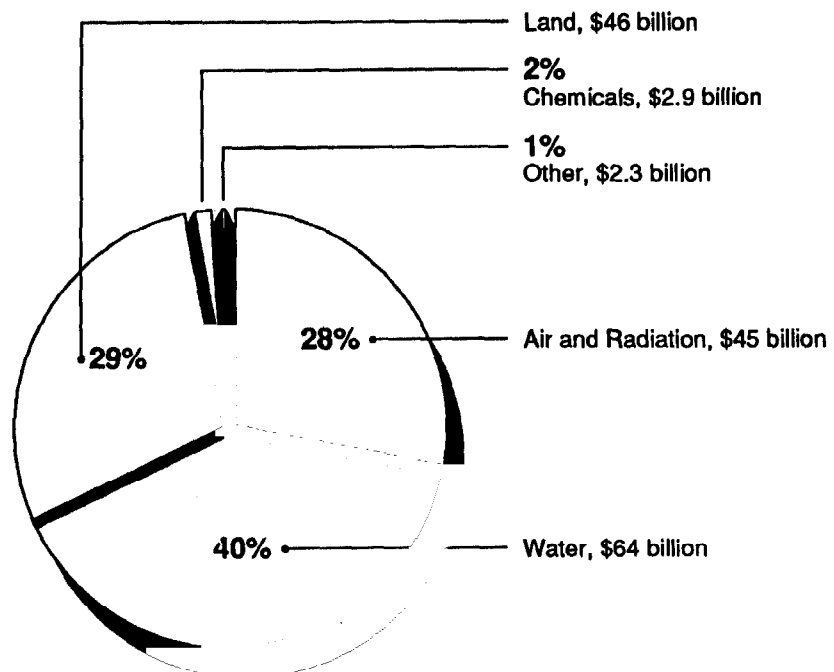
²See the Congressional Research Service's report for the Congress entitled *Environmental Issues: National Public Opinion Polls* (Aug. 22, 1990). The results of the New York Times poll are based on telephone interviews with a national sample of 1,515 adults, 18 and older, contacted between March 30 and April 2, 1990. The survey did not address how much people would actually be willing to pay for added environmental protection.

must pay to abate and control pollution also continues to grow. As a result, the nation will not be able to meet all public environmental expectations, at least not all at once and not in the traditional ways. Therefore, opportunities must be identified to address problems more effectively and efficiently in order to make further progress toward environmental goals.

Trends in Pollution Control Costs

According to EPA projections, by the year 2000 the United States could be spending \$160 billion annually on pollution control—almost 90 percent more than was spent in 1987. As shown in figure 1.1, annualized costs for controlling water pollution are projected to account for the largest portion, about 40 percent, of environmental costs. Meeting requirements of the air and land programs will each account for about 28 percent of the cost, and chemical regulation will account for about 2 percent.

Figure 1.1: Shares of Total Pollution Control Costs in the Year 2000, by Environmental Medium



Note: Costs were annualized at 7 percent in 1986 dollars.
Source: GAO's analysis of EPA data.

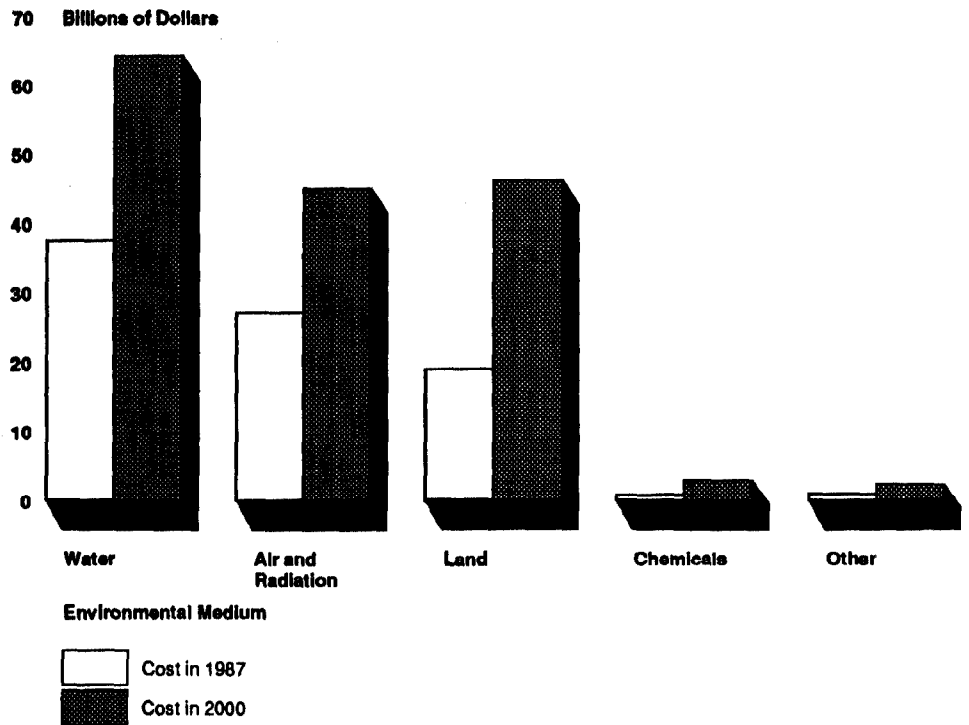
Pollution control costs are projected to continue to rise beyond the year 2000 even if no new environmental statutes are enacted. For example, the annual costs of implementing the 1990 Clean Air Act amendments are estimated to add from \$29 billion to \$36 billion to current air pollution expenditures by the year 2005.³ However, several environmental statutes, including the Resource Conservation and Recovery Act and the Clean Water Act, are due for reauthorization in the next several years and could result in further environmental controls. Costs to comply will rise even higher if laws to address new environmental problems, such as global warming, are passed.

**Control Costs, by
Environmental Medium**

EPA projects that costs will rise for pollution control in every environmental medium, but the increases will not be borne proportionately among programs. (See fig. 1.2.)

³Paul R. Portney, "Economics and the Clean Air Act," Journal of Economic Perspectives, Vol. 4, No. 4 (Fall 1990).

Figure 1.2: Cost to Protect the Environment Will Rise Dramatically by the Year 2000



Note: All figures are in 1986 dollars.
Source: GAO's analysis of EPA data.

Programs for controlling land pollution—including the Superfund program to clean up abandoned hazardous waste sites, hazardous and solid waste management, and the leaking underground storage tank program—are projected to increase the most, growing by nearly 2-1/2 times to \$46 billion. Superfund-related program costs are expected to increase most sharply, rising from \$683 million in 1987 to over \$8 billion by the year 2000. About \$22 billion will go toward collecting and disposing of solid waste, \$12 billion to managing hazardous waste and cleaning up hazardous waste facilities that are in operation, and \$3.7 billion to repairing and replacing underground tanks that store petroleum or other substances.

Although costs for controlling water pollution will increase over 70 percent to more than \$64 billion in the year 2000, the share these programs contribute to total pollution control costs will drop 4 percent. About \$23 billion consists of private spending for treating industrial wastewater before it is discharged into treatment plants. Drinking water protection

costs are expected to double, growing from \$3.1 billion in 1987 to \$6.6 billion in the year 2000, primarily because of the 1986 Safe Drinking Water Act amendments.

Costs for air and radiation programs will rise over 65 percent from their 1987 level to \$45 billion in the year 2000, but will comprise 4 percent less of total pollution control costs than they do today. Nearly all of these costs will be allocated to controlling air emissions, with about two-thirds spent on stationary sources, such as factories.

The costs of chemical regulation will increase to \$2.9 billion—over 3-1/2 times their 1987 level—and will account for about 2 percent of total pollution control costs in the year 2000. Pesticide control programs will account for \$1.6 billion, and compliance with and implementation of the Toxic Substances Control Act will cost over \$1.2 billion. About 55 percent of the costs associated with this law will go toward asbestos abatement.

Cost Shifts Among Different Sectors

Not only will the shares of environmental expenditures in the next 10 years shift among pollution control programs, but the cost burden of these programs will shift among federal, state, and local governments and the private sector, according to EPA. In 1987, the private sector accounted for 63 percent of total costs, local governments 22 percent, EPA about 8 percent, state governments less than 4 percent, and federal agencies other than EPA about 3 percent. By the year 2000, EPA, the states, local governments, and the private sector will account for slightly lower shares of the total costs. However, the share borne by federal agencies other than EPA is expected to more than double to almost 8 percent of total pollution control costs. Outlays by the Department of Energy and the Department of Defense for hazardous waste cleanup will constitute a substantial share of the increased expenditures.

Capital Investment Requirements

Capital expenditures for pollution control are expected to fluctuate between now and the year 2000, growing from \$30 billion in 1987 to \$43 billion in 1992 and then falling slightly until 1998, the deadline for upgrading or replacing underground storage tanks. In 1998, EPA estimates that capital expenditures will then rise to \$47 billion.

However, as a portion of total national capital investment, capital costs for pollution control are expected to follow a generally downward trend over the next 10 years. Expenditures for pollution control equipment,

which accounted for 2.9 percent of all capital investment in 1989, are expected to drop to about 2 percent in 1997. However, again because of the underground storage tank upgrade/replacement deadline, these costs are projected to rise again to 2.7 percent in 1998. After 1998, capital outlays for pollution control are expected to drop to 1.7 percent of all capital investment by the year 2000.

Benefits of Environmental Controls

While costly, environmental controls have resulted in substantial and valuable benefits in human health, recreational opportunities, visibility, and general environmental integrity. Assigning a monetary value to these benefits, however, has proven a much more difficult task than estimating costs. In general, it is easier to assign dollar values to the benefits of air and water regulations than to those of other areas because better information is available on the quantities, exposures, and adverse effects of air and water pollutants. Whatever the program area, ranges of benefits estimates tend to vary widely, depending on the analytic assumptions and the amount of scientific uncertainty involved. For example, a recent analysis of the costs and benefits associated with the Clean Air Act amendments of 1990 estimates annual benefits ranging from \$6 billion to \$25 billion (in 1989 dollars), with an annual cost ranging from \$29 billion to \$36 billion.⁴ A 1982 analysis of water quality improvements under the Clean Water Act estimated benefits in the range of \$3.8 billion to \$18.4 billion (in 1978 dollars).⁵ Similar national estimates are not available for EPA's hazardous waste programs.

Objectives, Scope, and Methodology

While efficiency in environmental programs has always been an important objective, the anticipated increases in costs to both public and private sectors suggest the need for a renewed emphasis on cost-effectiveness. We have highlighted the need for change, as well as opportunities, in past studies, including our 1988 general management review of EPA and recent testimony before the Congress on EPA's budget and on issues involved in elevating EPA to Cabinet-level status. (See Related GAO Products for a list of these studies.)

This report draws on these efforts and discusses ways to redirect federal policies and programs to make environmental protection efforts more effective and efficient. In addition, we held a symposium in June

⁴See Portney, "Economics and the Clean Air Act."

⁵See Myrick A. Freeman, *Air and Water Pollution Control: A Benefit-Cost Assessment* (New York: John Wiley & Sons, 1982).

1990 to elicit ideas from environmental experts in business, government, and other groups on ways to maximize the return of each dollar spent on environmental protection (see app. I for a list of participants). Discussion centered on (1) priorities for federal spending, (2) alternative sources of revenue to meet environmental goals, and (3) market-based incentives and other approaches to pollution control and prevention.

We conducted our review between March and November 1990 in accordance with generally accepted government auditing standards. Participants in our June 1990 symposium reviewed a draft of the report, as did EPA officials with responsibility for the various topics this report addresses. We incorporated their comments where appropriate.

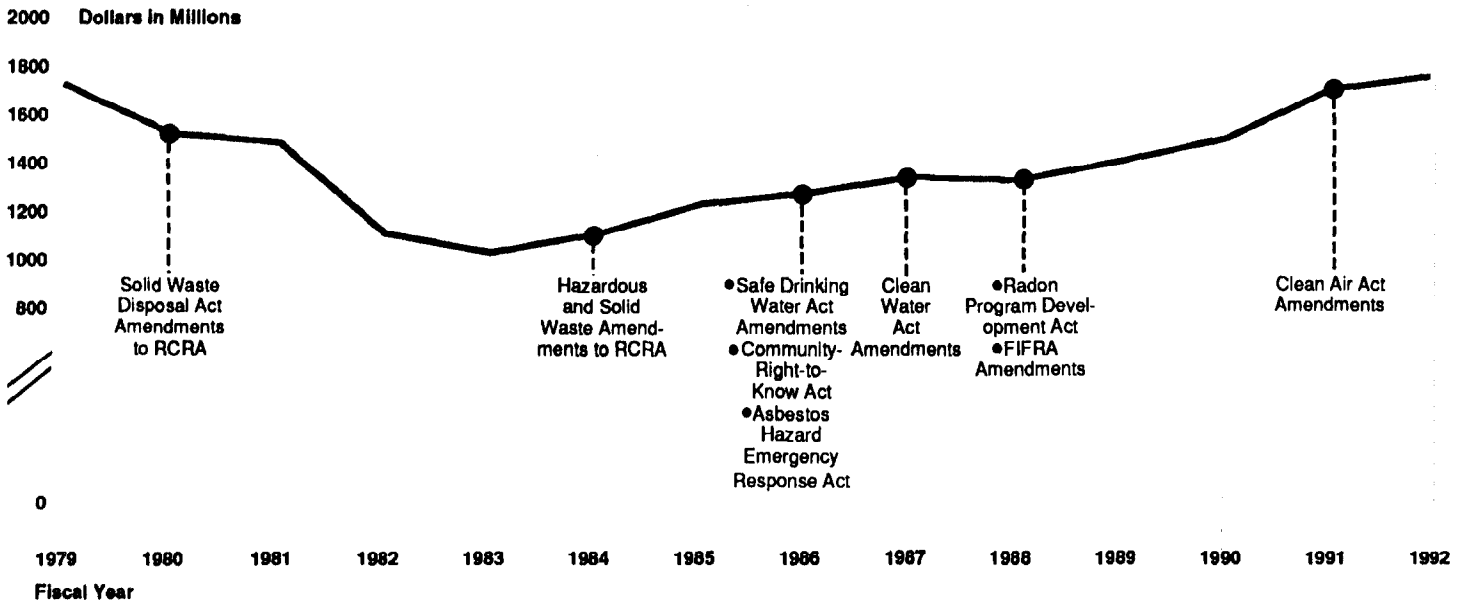
Priorities Should Reflect Environmental Risk

Since EPA's establishment in 1970, the federal government has developed a complex system of laws and regulations to address the nation's environmental problems. Over the years, as environmental threats were identified, the Congress has responded by enacting laws to address each problem, adding another piece each time to a statutory framework that set EPA's agenda. However, these laws were not coordinated or integrated to provide EPA with an overall system for prioritizing problems so that the most serious problems were addressed first. The federal budget deficit and other considerations now make it increasingly important that environmental priorities reflect an understanding of relative risks to human health and the environment. Doing this will be difficult, however, as long as public policy and, in particular, the budget allocation process is dominated by public perceptions of risk rather than by scientific and expert judgment.

Increasingly Limited Resources Make It Important to Set Priorities

Federal priority-setting, while always important, becomes particularly critical in times of tight fiscal and economic constraints. It is especially important for EPA to order its activities because its responsibilities have increased substantially over the last decade, while its operating budget (which covers all programs other than grants for Superfund, the cleanup of underground storage tanks, and the construction of wastewater treatment plants) has barely increased (see fig. 2.1).

Figure 2.1: EPA's Operating Budget Has Remained Relatively Flat, While the Agency's Responsibilities Have Increased



Abbreviations: RCRA, Resource Conservation and Recovery Act; FIFRA, Federal Insecticide, Fungicide, and Rodenticide Act.

Notes: All figures are in 1982 dollars and cover operating programs only. Construction grants, Superfund, and grants for leaking underground storage tanks are excluded.

Source: GAO's analysis of EPA data.

Since 1979, EPA's operating budget has not increased much above the levels approved that year. In constant 1982 dollars, EPA's operating budget in fiscal year 1979 was \$1.7 billion. The following year, the budget began to decline, a trend that was not halted until after 1983, when the operating budget was \$1.0 billion. It was not until fiscal year 1991 that the operating budget returned to its 1979 level.

At the same time, EPA's scientific and regulatory responsibilities grew considerably. During the 1970s, the Congress enacted almost a dozen major environmental laws (listed in app. II). In the 1980s, several of these laws were amended to give EPA substantially increased responsibilities. For example, amendments to the Resource Conservation and Recovery Act in 1984, known as the Hazardous and Solid Waste Amendments, broadened EPA's responsibilities for regulating the generation, transportation, treatment, storage, and disposal of hazardous waste.

The amendments also created a new regulatory program for underground storage tanks and directed EPA to issue new regulations to implement the program. In 1986, the Safe Drinking Water Act was amended, requiring EPA to regulate 83 specific drinking water contaminants. In the same year, the Asbestos Hazard Emergency Response Act required EPA to set standards for responding to the presence of asbestos in school buildings and to study the problem of asbestos in other public buildings, such as commercial and government buildings.

Priorities Now Guided by Public Perception of Risk

Impelled by budgetary constraints and a growing list of environmental problems, EPA, in the late 1980s, began to consider whether its resources were being spent on the problems that pose the greatest risk to public health and the environment. The agency subsequently concluded that the nation is actually devoting more resources to problems that have captured public attention than to problems that are lesser known but potentially more serious.

In an effort to find ways to target the agency's resources where they would have greatest benefit, EPA's Administrator in 1986 commissioned a team of about 75 senior agency managers and technical experts to assess the risks associated with a range of environmental problems. In its report, entitled Unfinished Business: A Comparative Assessment of Environmental Problems, the project team concluded that EPA's program priorities, as reflected in its budget, did not correspond well with rankings of environmental risk.¹

The report identified 31 environmental problems, ranging from global climate change to drinking water contamination and air pollution, and ranked them according to four broad categories: cancer risks, non-cancer health risks, ecological risks, and welfare risks, such as damage to crops, vegetation, or buildings.² The study concluded that many problems the team judged to be of relatively low risk, such as contamination from active and abandoned hazardous waste sites, were receiving extensive public attention and federal resources. By contrast, problems the team judged to be of higher risk, such as indoor air pollution, received far less attention and fewer resources. (Table 2.1 highlights some disparities in

¹Unfinished Business: A Comparative Assessment of Environmental Problems, EPA Office of Policy, Planning, and Evaluation (Washington, D.C.: 1987).

²The study did not compare the importance of one type of risk versus another or consider factors such as the costs and availability of technologies to control the risks, benefits to society of activities that cause the environmental problems, or EPA's legal authority to deal with them. Risks were assessed as they existed at the time of the study, given the levels of control then in place.

rankings by the project team and the public.) Overall, the study found that EPA's priorities appeared to be more closely aligned with public perceptions of risk, often expressed through congressional mandates, than with scientific assessments of risk.

Table 2.1: Rankings of Selected Environmental Risks by EPA and the Public

Rankings by EPA	Rankings by the public
Higher Risk	
Global warming	Chemical waste disposal
Indoor air pollution, including radon (high health risk)	Water pollution
Exposure to chemicals in consumer products (high health risk)	Chemical plant accidents
Surface water pollution (high ecological risk)	
Lower Risk	
Hazardous waste sites—active and inactive	Indoor air pollution
Underground storage tanks	Exposure to chemicals in consumer products
	Global warming

Source: GAO's analysis of EPA data reported in the *Unfinished Business* report. Rankings by the public are based on a Roper Organization poll and are therefore not directly comparable to rankings by EPA.

In 1989, EPA's current Administrator asked the agency's Science Advisory Board (SAB)—a group of eminent scientists and other experts from academia, industry, state government, and public interest groups—to evaluate the *Unfinished Business* report and examine strategic options for reducing risk. The SAB took a slightly different approach in its assessment, including as risks, for example, habitat alteration and destruction; it also declined to rank human health risks. Nevertheless, the overall finding of its report, released in September 1990, was much the same—that federal environmental laws reflect public perceptions of risks more than they do scientific understanding, and that EPA's resources are targeted likewise.³

To correct this situation, the SAB made 10 recommendations to the Administrator of EPA. In summary, the SAB recommended that EPA target its efforts on the basis of opportunities for reducing both ecological and human health risks, improve its ability to assess and manage environmental risks, reflect risk-based priorities in its strategic planning and

³*Reducing Risk: Setting Priorities and Strategies for Environmental Protection*, Report of the Science Advisory Board, Relative Risk Reduction Strategies Committee, to William K. Reilly, Administrator, EPA (Washington, D.C.: Sept. 1990).

budget processes, and improve the public's understanding of environmental risks.⁴

Difficulties in Setting Priorities According to Risk

While a laudable end, incorporating the concept of relative health and environmental risks into decisions on environmental priorities is nevertheless difficult. The lack of information on risks and benefits, the ethical dimensions of subjecting populations to known risks, and the inevitable value judgments involved, as well as the statutory framework under which EPA operates, all affect the agency's ability to establish priorities that reflect relative risk.

Lack of Information

The SAB report, like Unfinished Business before it, noted that good data to evaluate risks do not exist in many cases. This fact complicates efforts to evaluate risk on a consistent basis and to find the best strategies for reducing risk. It is also difficult to determine the economic benefits of controls because of the tendency when analyzing natural resources to undervalue "public goods," such as clean air, that are unpriced in markets.

The public is generally unaware of the relative risks that various environmental problems pose, participants in our June 1990 symposium pointed out. The Deputy Administrator of EPA stressed the need for EPA to develop the data needed to identify the most serious risks and to keep the public informed about the relative seriousness of various environmental problems.

Ethical Considerations and Value Judgments

Ethical considerations and value judgments also enter into any apportionment of risk. The SAB report, for one, pointed out that policy choices have ethical as well as scientific bases and that no matter how sophisticated the tools to reduce environmental risks become, subjective values will—and should—influence the ranking of risks. The questions that must be addressed are difficult, including, for example, whether the health risks posed to the aged are more or less serious than health risks posed to infants and whether risks of cancer are more or less serious than threats to reproductive processes.

⁴In addition, the SAB recommended that EPA (1) make greater use of nonregulatory approaches to reducing risk, including market incentives and pollution prevention, (2) increase its efforts to integrate environmental considerations into broader aspects of public policy, and (3) develop improved analytical methods to value natural resources and to account for long-term environmental effects.

Participants at our symposium raised some of these same issues. For example, the director of the Washington office of the United Nations Environment Programme was concerned about the ethical issues involved in determining when a particular environmental risk is “acceptable.” Similarly, the Counsel for the House Committee on Energy and Commerce reminded participants that the Congress must be responsive to public perceptions of the seriousness of various environmental problems; risk assessments by themselves are not sufficient for setting environmental policy. Industry and individual citizens may differ fundamentally in their views, he said, using as an example the issue of cleaning up hazardous waste sites. Industry may question the need to clean up a site to a level beyond what is required, while citizens with a family member suffering from cancer they believe was caused by the hazardous waste site may feel that the property needs to be returned to its original condition.

Current Statutory Framework

Further complicating EPA’s ability to set priorities among its programs is the fact that its statutory responsibilities are numerous and diverse, with different and sometimes conflicting standards of risk. Because EPA was created under an executive reorganization plan, it has no formal, overarching legislative mission. Instead, its statutory responsibilities are set forth in a dozen or so separate pieces of legislation that tend to assign pollution control responsibilities according to environmental medium (such as water or air) or category of pollutant (see app. II for a list of the major laws EPA administers). These numerous legislative mandates have led to the creation of individual EPA program offices that have tended to focus solely on reducing pollution within the particular environmental medium for which they have responsibility, rather than on reducing overall emissions.

Occasionally, statutes and standards may overlap, as in the case of drinking water quality, which is protected from chemical pollution under two laws that deal with hazardous waste (the Resource Conservation and Recovery Act and the Superfund law) as well as the Safe Drinking Water Act. Similarly, a single pesticide may be regulated under the Federal Food, Drug, and Cosmetic Act as well as under the Federal Insecticide, Fungicide, and Rodenticide Act.

According to some, the difficulties of administering a diverse array of environmental laws suggest a need to consolidate EPA’s responsibilities into a single, unified environmental statute that forms an organic act for the agency. A model law drafted by The Conservation Foundation—the

Environmental Protection Act—would establish a Cabinet-level Department of Environmental Protection with a single mission: to improve the overall quality of the environment as effectively and efficiently as possible. The act would set a single standard—the prevention of “unreasonable risk”—for all environmental regulations, regardless of the source of the pollutant or the location into which it is discharged. Six factors would be considered in applying this standard to specific cases: (1) the risk to humans and the environment, (2) the economic costs to society and the distribution of those costs within society, (3) the effects on technological innovation, (4) the existence of substitute products or methods, (5) the feasibility of implementing proposed actions, and (6) the potential effects on other nations. Those who proposed the model law argued that under such a statute, regulatory priorities, budget allocations, and research initiatives could be considered for the entire agency, not just for one program at a time.

In a May 1989 interview with the GAO Journal, a former EPA Administrator stated his support for an organic act that would require EPA to develop a long-range strategy and would give the agency the power to override some of the elements in existing environmental statutes. In his view, such an act could provide EPA with much-needed flexibility to set priorities for environmental problems and find the best approaches to resolving them.

Two bills introduced during the 101st Congress addressed the idea of integrating existing major environmental statutes. Senate bill S. 2006, to create a Cabinet-level Department of Environmental Protection, called for a Commission on Improving Environmental Protection to study and make recommendations to the President and the Congress on the need for comprehensive administrative and legislative reforms; its House counterpart, H.R. 3847, had similar provisions. In its testimony on the legislation, GAO endorsed such a study, pointing out that a unified environmental statute might make it easier for EPA to set priorities and allocate resources in response to its evolving understanding of environmental problems.⁵ Although the legislation was not enacted, a similar bill (S. 533) was approved by the Committee on Governmental Affairs in the 102nd Congress; a companion bill is expected to be introduced in the House.

⁵Creation of a Department of the Environment (S. 2006) (GAO/T-RCED-90-26, Feb. 8, 1990).

Risk Analysis Required in Planning and Resource Allocation

Despite the difficulties involved in incorporating relative risk in environmental priorities, our 1988 general management review urged EPA to incorporate risk in its planning and budgeting, recommendations to which the agency has already begun to respond.

Our management review generally recommended that the agency change its annual planning and budget systems to identify the most serious environmental issues and target resources to addressing these issues. We also recommended that, when necessary, EPA use the flexibility that it has to reprogram funds during the budget year to address high-priority problems.⁶

EPA itself recognizes the importance of distinguishing among problems. During our symposium, EPA's Deputy Administrator stressed the importance of the Congress and EPA developing the ability to distinguish between acute environmental risks that require immediate action and other problems that do not have to be immediately resolved. In his words, "We don't have to have every problem solved 100 percent immediately." Instead, EPA needs to identify the most serious risks, calculate the cost to reduce them, and together with the public, decide what actions need to be taken.

In an interview with Science magazine published in August 1990, EPA's Assistant Administrator for Policy, Planning, and Evaluation voiced a similar theme. He said that EPA is seeking ways to focus the agency's resources where they would get the biggest payoff, factoring in not only how risky a problem is but how feasible and costly the various "fixes" are.

In the agency's March 1990 formal response to our general management review, EPA's Administrator described several efforts either completed or under way to address our recommendations and improve the agency's ability to use relative risks in environmental policy-making. For example, as described earlier, the SAB reviewed and updated EPA's comparative risk assessment. The agency has also initiated an agencywide Strategic Planning, Budgeting and Accountability Program, with the goal of improving EPA's ability to set priorities and allocate resources

⁶EPA's reprogramming authority is discussed in much greater detail in our general management review. Basically, reprogramming can take two forms: (1) shifting funds between program elements within a single appropriation and (2) shifting funds between program elements in different appropriations. EPA can shift funds up to \$1 million between program elements within a single appropriation without formal congressional approval. The agency can shift funds between program elements in different appropriations with approval from the Office of Management and Budget and the Congress.

according to risk and risk reduction. While developing its budget for fiscal year 1991, EPA analyzed each budgetary change in terms of risk reduction benefits either gained or lost because of resource shifts. In addition, the agency initiated a quarterly review to ensure the identification of areas that might need reprogrammed funds.

As discussed in chapter 5, state and particularly local governments must pay a large share of the costs of federally required environmental programs. Therefore, these sectors need to be involved in helping to establish environmental priorities. In this regard, the Administrator reported that EPA is taking steps to involve states in a long-term strategic planning effort and has established a state and local programs committee under the auspices of the National Advisory Committee on Environmental Policy and Technology to promote the exchange of information between EPA and the states.

EPA is also attempting to address the other side of the problem: public environmental education. The agency recently created an Office of Environmental Education to implement the recently enacted National Environmental Education Act, intended to increase public understanding of the natural environment and to advance and develop environmental education and training. It establishes an education and training program for teachers, an educational grant program, and college-level internships at federal agencies.

The Administrator also receives advice on environmental education from the agency's Environmental Education and Training Committee, also under the National Advisory Council for Environmental Policy and Technology. This committee, in its 1990 annual report, stated its intention to undertake initiatives that respond to the SAB report's recommendations on educating the public. However, it is not clear how the committee intends to educate the public about the comparative seriousness of various health and environmental risks.

Conclusions and Recommendations

Despite the many difficulties involved in setting priorities—among these, the lack of adequate information about risks, the numerous statutory mandates, and ethical considerations—EPA has nevertheless begun to make some progress toward a more risk-based system. We encourage EPA to continue its many initiatives.

However, much remains to be done to translate information into public policy. Primarily, congressional involvement in setting environmental

priorities is essential. While EPA has the ability and, arguably, the responsibility to assess the relative risks posed by environmental problems and to educate the public about them, it nevertheless remains the Congress' responsibility to translate that information into legislation. We therefore recommend that the Administrator, EPA, work closely with the Congress to identify opportunities for shifting resources from problems whose risks to human health or the environment are less severe to problems whose risks are greater.

Since public opinion contributes heavily to the Congress' agenda, the public, too, must be kept better informed about environmental risks. Consequently, we recommend that the Administrator direct some portion of the agency's educational activities specifically toward informing the public about the relative seriousness of the nation's environmental problems.

Matters for Congressional Consideration

Because of its role in setting environmental priorities, we believe that the Congress should consider the following:

- In authorizing and appropriating funds for EPA, the Congress should take into account EPA's reordering of budget priorities reflecting relative risks to human health and the environment, as well as the costs and feasibility of reducing these risks.
- A unified environmental statute could significantly enhance EPA's ability to set priorities and more effectively and efficiently address the nation's most serious problems. Because of the enormous changes that such an act would entail in existing legislation, the Congress may wish to establish a study commission, such as that called for in House and Senate proposals to create a Cabinet department of environmental protection, to evaluate the merits of integrating existing environmental legislation.

Measuring Environmental Results Is Critical to Program Effectiveness

Although the ultimate objective of environmental programs is to clean up or prevent unacceptable levels of pollution, EPA has not had the information necessary to judge its success. While EPA has developed some indicators—national air quality standards, for example—the agency has generally relied on activities alone, such as numbers of enforcement actions taken, as indicators of progress. Since our 1988 general management review, which found that EPA still faced difficulties in determining whether its programs are achieving intended results, EPA has made some efforts to link activities with changes in environmental conditions and trends and seems committed to further development and use of environmental measures. The establishment of a center or bureau within EPA for the collection, analysis, and dissemination of environmental data would help focus EPA's efforts to develop environmental measures and give them the attention they deserve.

Activity-Based Measures Inadequate for Assessing Progress

The information system that EPA uses to monitor its performance generally reflects what EPA does, not what it achieves. Established in 1984 as the Strategic Planning and Management System, the system was renamed the Strategic Targeted Activities for Results System (STARS) in 1989. The system was intended, in part, to hold program offices and regions accountable for achieving certain objectives. But the measures it uses, such as numbers of regulations and permits issued and inspections conducted, are not operationally linked to the outcomes the agency seeks. For example, one objective of EPA's Office of Water, described in its 1988 operating guidance, was to achieve and maintain a high level of compliance in its underground injection control program. The measure it proposed to use, however, was the number of inspections of injection wells. Thus, although inspectors were expected to carry out a certain number of inspections, they were not held accountable for compliance rates. Altogether, 141 of the 145 measures contained in the management system for fiscal year 1988 were related to the agency's or polluters' activities, rather than the effects of those activities on environmental conditions. Before 1989, only the air and the drinking water programs used environmental indicators to assess progress, although EPA had identified 23 problem areas.

As we reported in our general management review, an EPA internal document described two cases that illustrate the insufficiency of activity-based measures alone. The first case, involving Puget Sound, was a program success story according to activity-based indicators: All water pollution discharge permits had been issued, all applicable waivers of program requirements were being processed, and so on. However, once

EPA shifted its attention to environmental accomplishments, it found that shellfish beds were being closed at an increasing rate, contaminated sediment was being found almost wherever researchers looked, and fish tumors and other signs of poor biological health abounded. In the other case, EPA assumed that requiring specific treatment equipment at two pulp mills discharging toxic wastes into Washington State's polluted Grays Harbor would improve the survival rate among young salmon passing through the harbor on their way out to sea. The action did not solve the problem, nor was anyone clearly responsible for following up to resolve the issue.

Difficulties in Developing Environmental Indicators

EPA has historically relied on activity-based measures because of the inherent technical difficulties in establishing linkages between program activities and environmental improvements and a lack of information on ambient environmental conditions. Because of factors beyond EPA's control, such as changes in weather patterns or economic conditions, it can be difficult to establish a direct cause-and-effect relationship between the actions EPA and polluters take and changes in environmental conditions. Furthermore, the data needed to understand the relationships are often extensive. Such data might include, for example, the potential toxicity of chemicals, their environmental effects, the extent of human exposure and environmental contamination, and the effectiveness of technologies to reduce human and environmental exposure.

EPA has been aware of the need for environmental measures since the mid-1970s, but has made little progress in developing them. One notable exception has been the national air monitoring system, which monitors levels of regulated air pollutants. Nevertheless, in a 1980 report on environmental accomplishments, EPA could illustrate accomplishments only by way of examples.¹ In 1986, EPA held a workshop to develop environmental measures for managing groundwater protection, but no meaningful measures of environmental quality were developed because data collection costs were considered prohibitive.

Apart from the technical difficulties in developing measures, EPA has been hindered by a lack of environmental monitoring data—the result of cutbacks in the agency's national monitoring program. According to officials of EPA's national monitoring program, leadership changes and high costs were contributing factors. They also attributed the pressure

¹National Accomplishments in Pollution Control: 1970-1980, Some Case Histories, EPA (Washington, D.C.: Dec. 1980).

to cut funding for monitoring to the absence of a specific statutory mandate or deadline, making these efforts less competitive with mandated programs and activities. The director of EPA's Strategic Planning and Management Division explained that EPA has traditionally considered itself primarily a regulatory agency and has therefore focused its attention and resources almost exclusively on setting standards and issuing permits rather than on developing environmental data.

EPA's Efforts to Develop Environmental Indicators

Since our 1988 general management review, EPA has undertaken a series of efforts intended to improve the agency's ability to measure environmental results. One of these is the Strategic Planning, Budgeting and Accountability initiative that requires each program to develop a 4-year strategic plan that includes measurable goals clearly related to reducing environmental risks, together with statements of what indicators would be used to evaluate progress toward each goal.

EPA is also in the process of redesigning its management accountability system, STARS, so that it will have the capability to link program goals with activities and with environmental results. STARS will allow users to retrieve information by EPA program, environmental problem area, budget element, or environmental indicator. Agency officials believe that the environmental indicators portion of the system will be fully in use in 1993, as more data are available to measure environmental results. As of April 1990, five of 23 programs or problem areas—air, drinking water, Superfund, toxic substances, and coastal protection—had either developed or had environmental indicators under development.

EPA has also developed the Environmental Monitoring and Assessment Program, intended to monitor ecological status and trends and to develop innovative methods for anticipating emerging problems. The program, initiated in 1990, will evaluate and use indicators that collectively describe the overall condition of an ecosystem by setting up regional monitors of environmental conditions, combined with data banks of regional compliance, demographic, and socio-economic information.

Recognizing the fundamental importance of good information to effective program performance, we have supported the concept of having a unit to oversee the collection, analysis, and dissemination of environmental data as a way to improve EPA's ability to measure environmental

results across all its programs.² House bill H.R. 3847 and Senate bill S. 2006, to create a Cabinet department for the environment, called for the establishment of a bureau for environmental statistics; a similar provision is contained in Senate bill S. 533 before the 102nd Congress. Intended to serve as a central clearinghouse for all environmental data, the bureau was also expected to collect a comprehensive set of environmental quality measures on the nature and amount of pollutants in the environment and their effects on the public and the environment. EPA plans to create such a center within the agency in fiscal year 1993.

Conclusions and Matters for Congressional Consideration

Identifying and developing measures of environmental quality are necessary to sound environmental management. Such measures, if tied to program activities and polluters' actions, would allow EPA to assess its progress in achieving environmental goals.

EPA agrees that it should measure its success in terms of actual changes in environmental conditions and trends over time. The agency seems committed to making the necessary changes, and we encourage its efforts to establish an agencywide system for measuring its progress in improving environmental conditions.

As the 102nd Congress deliberates establishing a Cabinet department for the environment, it may wish to consider establishing a bureau or center for environmental statistics as a means to strengthen EPA's ability to measure environmental results.

²Creation of a Department of the Environment (S. 2006) (GAO/T-RCED-90-26, Feb. 8, 1990) and Creation of a Department of Environmental Protection (H.R. 3847) (GAO/T-RCED-90-25, Feb. 7, 1990).

Nonregulatory Incentives for Environmental Protection Should Be Pursued

Although the environmental regulatory framework built up over the past 20 years has substantially reduced various pollutants, a number of environmental problems remain that the traditional approaches cannot resolve, or that other methods could deal with more efficiently and effectively. These problems include pollution from some small, diffuse sources and pollutants that cross from one environmental medium to another. Selectively supplementing traditional regulatory approaches with market incentives, efforts to prevent pollution, and other nonregulatory approaches may be less costly to the economy as well as more effective in controlling or preventing pollution.

Advantages and Disadvantages of Traditional Regulatory Approaches

The environmental regulatory system currently in place has been effective in controlling large, centralized sources of pollution, such as factories and power plants, by relying on a variety of approaches that may loosely be grouped under the category "command and control." Typical components of this system include health- or technology-based standards for the discharge of pollutants into the environment, as well as construction and operating permits and enforcement procedures for facilities based on these standards.

This system has a variety of benefits. For one, it provides a fairly clear basis for enforcement: It is not difficult to confirm, for example, that firms have installed a particular piece of equipment to reduce emissions of air pollutants. Equity is considered to be another positive feature of traditional regulation, which generally requires uniform abatement technologies, such as for water and new stationary air pollution sources.

EPA also reports that, at least in the case of several important air pollutants, regulated controls have resulted in environmental improvements. EPA's report Environmental Investments: The Cost of a Clean Environment estimates that between 1970 and 1988 the levels of six key air pollutants fell significantly below those that would have existed in the absence of controls. Lead emissions are now only 3 percent of what they would have been if controls were not established, particulate matter emissions 30 percent, carbon monoxide 43 percent, volatile organic compounds and sulfur dioxide 58 percent, and nitrogen oxide 72 percent. EPA has been unable to establish that regulatory efforts improved water and land quality or resulted in less human exposure to chemicals. However, EPA's Cost of a Clean Environment report states that water pollution levels resulting from both industrial and municipal point sources have been well below those of the early 1970s. In industrial discharges, for example, levels of total suspended solids and biological oxygen

demand—two traditional indicators of water pollution—declined by 96 and 93 percent, respectively, between 1982 and 1987.

Despite these indications of improvement, a number of serious environmental problems remain, partly because their sources are small, numerous, or simply difficult to control with a traditional “command and control” approach. For example, individually, automobiles now emit fewer air pollutants, but in aggregate, their increased numbers continue to cause serious air pollution. Millions of other small sources of pollution—such as households, dry cleaners, gas stations, and other small establishments that produce hazardous wastes—also pose environmental problems. Other pollution problems, particularly water pollution, are created by diffuse and therefore difficult-to-control sources, such as urban runoff and pesticides used in farming.

Use of Market Incentives for Pollution Control

One solution proposed to deal with these more intractable pollution problems is greater use of market mechanisms that give polluters a financial reason to reduce pollution without specifying how to achieve the reductions. As described in a 1989 study by the Congressional Research Service (CRS),¹ market incentives may include the following:

- Taxes levied on effluent, involving a charge per unit of pollution, on the input causing the pollution, or on the output of the polluting activity. For example, a tax could be levied on the sulfur emissions from a coal-burning power plant, on the coal used to produce the power, or on the electricity generated by the plant.
- Fines or noncompliance fees, which can be used for violations of technology-based standards, the level of the fine determining the incentive provided to comply.
- Tradable discharge permits, which allow polluters to trade specified and limited amounts of pollution among themselves to achieve a “least cost” reduction in pollution, with abatement concentrated at the points of lowest cost.

Other incentives include deposits and refunds, public disclosure of information on pollutants, and the assignment of liability.

¹Using Incentives for Environmental Protection: An Overview, CRS, No. 89-360 (Washington, D.C.: June 2, 1989).

Advantages and Limitations of Market Incentives

Among the advantages of market incentives are the following:

- The potential for cost savings: For example, it has been estimated that the emissions trading program to control acid rain included in the 1990 Clean Air Act amendments could cost the economy between \$2 billion and \$3 billion less per year than the current system of controls.²
- Increased flexibility over traditional approaches: To some extent polluters can choose how, where, and when to make changes. Thus, firms that find it easier or less expensive to reduce emissions at one installation rather than another can do so as long as aggregate requirements for the area in which the firms are located are met.
- The potential to stimulate innovation: For example, instead of having to install particular equipment to control emissions, companies can devise their own solutions.

At the same time, market incentives require careful monitoring. CRS' 1989 study pointed out, for example, that in a complex economy it can be difficult to predict the rates and extent of reductions in pollution that a market-based system may achieve. A set tax on each unit produced of a pesticide, for example, might not reduce water pollution levels by the designated amount, requiring repeated changes in the tax level until water quality goals are achieved. In addition, market incentives such as tradable permits require well-organized markets for trading. An array of possible market imperfections, including too few buyers and sellers or lack of adequate information, among others, could also reduce the effectiveness of market-based approaches.

Experience With Market- Based Approaches

To date, EPA has had little experience integrating market-based approaches with the current regulatory regime. However, EPA has used two market-based approaches to control pollution, both trading programs: one to reduce air emissions and the other to reduce the lead content of gasoline. EPA's air emissions trading program, begun in 1974, assists polluters in meeting the requirements of the Clean Air Act at less cost. It contains four components codified in EPA's Final Policy Statement on Emissions Trading in 1986. Under the "netting" program, a facility can undergo a major modification without incurring the substantial additional control costs typically required if the facility's aggregate emissions do not increase. The "bubble" program allows an existing facility with multiple emission sources to combine them as a single

²See Project 88: *Harnessing Market Forces to Protect Our Environment* (Washington, D.C.: Dec. 1988) and Portney, "Economics and the Clean Air Act."

source, thus enabling owners to reduce emissions at any combination of the facility's sources as long as the necessary aggregate reductions are met. Under the "offset" program, new facilities can locate in an area that is not in compliance with national air quality standards if the new facilities reduce the region's aggregate emissions of the offending pollutant. They can do so by installing the best available control technology at their own sites and financing emission reductions at existing sources. A fourth program, "banking," allows facilities to go beyond required emission reductions, thereby earning credits for future use or for sale to other facilities.

A congressional study of market incentives, the Project 88 report conducted for Senators Timothy E. Wirth and John Heinz, found that EPA's air emissions trading programs had not been used extensively at the time of its analysis because states were not required to participate and firms were uncertain about the future course of the programs.³ Nonetheless, citing a private study,⁴ Project 88 reported that EPA's trading program, even in its limited form, saved more than \$4 billion in control costs without adversely affecting the environment.

EPA's lead trading program, started in 1982 and completed during the late 1980s, was intended to facilitate the transition to lower lead levels in gasoline while providing some flexibility for refineries, particularly smaller ones, that might have technical difficulties in meeting the tighter standards. Under the program, refineries that added less lead to gasoline than allowed by EPA could sell "extra" lead rights to refineries that desired to add more lead than allowed. Both large and small refiners created lead rights and stored, or "banked," them for future use or trading.

CRS reported in its 1989 study that EPA's lead trading program was effective in reducing the costs of environmental compliance, attributing its success to previous industry experience in trading products and additives, minimal administrative requirements for trading, and the ability to bank lead reductions exceeding EPA standards. Under the program, EPA lowered limits on gasoline lead content in 1982 and further in 1985. Trading became more active as the program developed: The portion of lead rights traded as a proportion of all lead used increased from under

³See also A Market Approach to Air Pollution Control Could Reduce Compliance Costs Without Jeopardizing Clean Air Goals (GAO/PAD-82-15, Mar. 23, 1982).

⁴Robert W. Hahn and G.L. Hester, "The Market for Bads: EPA's Experience With Emissions Trading," Regulation, Nos. 3/4 (1987), pp. 48-53.

10 percent in 1983 to almost 60 percent by the end of 1987. EPA estimated that the program would save over \$200 million.

The 1990 Clean Air Act amendments incorporate a program for reducing acid rain-causing emissions (sulfur dioxide and nitrogen oxides) through the use of market incentives. Affected power plants will be allowed to meet their required emission reductions by purchasing acid rain reduction credits from other firms able to reduce their emissions by more than the legislation requires. Had the Congress instead required the adoption of flue-gas desulfurization equipment as it did in the 1977 Clean Air Act amendments, the acid rain provisions would have cost \$2 billion to \$3 billion more annually.⁵

Some states—including California, Colorado, and Wisconsin—have also developed trading programs. According to CRS, which reported on the experiences of Colorado and Wisconsin, only limited trading had occurred at the time of its analysis in 1989. The purpose of Colorado's trading program for water pollution rights at Dillon Reservoir, developed during the early 1980s, is to reduce abatement costs and reduce phosphorus levels in the reservoir by allowing facilities to trade rights among themselves for the discharge of pollutants or pay for approaches that reduce nonpoint water pollution. By 1989, one trade had occurred involving one developer who paid to replace some septic systems with a sewer system. Wisconsin's permit trading program for water pollution at the state's Fox River was begun in 1981 with the goal of finding ways to meet regional water quality standards that had not been achieved under the required abatement technology. One trade took place between a paper mill and a municipal wastewater treatment facility.

Public Disclosure as a Tool to Control Pollution

The federal government has required companies to publicly disclose information as a means of encouraging reductions in pollution levels. Title III of the federal Superfund Amendments and Reauthorization Act of 1986, known as the Emergency Planning and Community Right-to-Know Act, requires facilities that produce, use, or store certain toxic chemicals to report annually to the public the amounts of toxic chemicals released to the environment. Using this information EPA compiles an inventory of toxic releases. Participants in our symposium believe that concerns about public opinion have motivated industries to reduce their stocks and emissions of toxic chemicals.

⁵Portney, "Economics and the Clean Air Act."

Pollution Prevention

Pollution prevention involves eliminating or reducing pollution at its source rather than trying to contain or treat it after it has been generated. Components of pollution prevention include waste minimization and recycling. In addition to its environmental benefits, reducing the waste byproducts that result from various industrial processes can cut the expense of environmental compliance for industry and lower enforcement costs for government.

Some industries have documented substantial cost savings from pollution prevention programs. For example, EPA reports that Chevron's Save Money and Reduce Toxics (SMART) program saved the company \$3.8 million during the program's first year (1987), in part by substituting nonhazardous for hazardous compounds for drilling mud. Chevron disposed of 44 percent less hazardous waste during 1987, and the company hopes to realize reductions of 65 percent by 1992.

Perhaps most importantly, reducing the level of pollutants generated offers a more permanent solution to pollution problems than simply shifting them from one environmental medium to another. This phenomenon is already apparent in the area of hazardous waste disposal, where the disposal of untreated wastes in land is tightly regulated in order to avoid contamination of soil and groundwater. In many instances, however, the only practical alternative to land disposal may be incineration, which may send the offensive substances into the air instead. If fewer wastes were produced at the outset, they would not have to be dealt with later in any form.

Pollution prevention can also play an important role in allowing the federal government to avoid future environmental liabilities. Years of neglect and inappropriate disposal practices have resulted in costly environmental liabilities, particularly at Department of Energy and Department of Defense facilities. The Congressional Budget Office estimates that the costs of hazardous waste cleanup and regulatory compliance activities at these and other federal facilities could exceed \$150 billion over the next three decades.⁶ Practicing preventive measures could not only lessen future environmental debt but also help remedy the unfortunate but accurate image of some federal facilities as major polluters.

⁶Federal Liabilities Under Hazardous Waste Laws, Congressional Budget Office (Washington, D.C.: Apr. 1990).

Obstacles to Pollution Prevention

To be effective, pollution prevention programs must overcome several barriers. As described by the Office of Technology Assessment in a June 1987 report, these include the lack of technical support and rewards for production managers to reduce waste, regulatory pressures that focus management's attention on mandated compliance deadlines instead of on voluntary waste reduction, and internal accounting systems that do not allocate environmental costs to specific production processes.⁷ Recycling as a waste reduction technique has long been considered an integral part of pollution prevention strategies, and an entire industry has been built around recovering useful materials from discarded items. However, the markets for recyclable materials have not always been reliable, and some recyclers have been unable to generate enough revenue to cover the capital and labor costs of separating, transporting, and processing the recycled materials.

EPA's Pollution Prevention Initiative

EPA's pollution prevention initiative is in its early stages but has high-level support within the agency. The Administrator of EPA has designated pollution prevention as one of the agency's principal priorities and has set as a goal a 25-percent reduction in the nation's waste by 1992. The Congress has also advocated pollution prevention in the Pollution Prevention Act of 1990, which requires EPA to collect and disseminate information and provide financial assistance to states. This law requires the EPA Administrator to identify barriers to waste reduction and to recommend to the Congress ways to eliminate them.

As part of EPA's pollution prevention efforts, the agency set aside \$11.8 million, or 2 percent, of its operating budget for fiscal year 1991 to fund 25 pollution prevention projects. The agency also created a Pollution Prevention Information Clearinghouse to provide information to the public about pollution prevention efforts they undertake. According to the Director of EPA's Pollution Prevention Division, EPA is working to ensure that the federal procurement process and product specifications emphasize pollution prevention and recycling whenever possible. In January 1991, EPA also prepared a report on the agency's strategy for preventing pollution.

⁷From *Pollution to Prevention: A Progress Report on Waste Reduction*, Office of Technology Assessment (Washington, D.C.: June 1987).

States' Experience With Pollution Prevention

As of 1988, according to the National Governors' Association, 36 states had enacted waste minimization programs.⁸ North Carolina's program, considered a model, includes an information clearinghouse, on-site technical assistance, informational technical assistance, and public education and outreach. The state claims that the program has reduced waste volumes by an average of about 30 percent. Massachusetts has a legislative goal of reducing the toxic waste generated in the state by one-half by 1997. Massachusetts plans to accomplish this by providing technical assistance to industry, establishing a university-based Toxics Use Reduction Institute, and developing a "whole facility," as contrasted with a "one pipe at a time," approach to environmental regulation.

Conclusions and Recommendations

Experience suggests that a variety of approaches—traditional "command and control," various market incentives, and pollution prevention—can be optimally combined to produce a more effective and less costly environmental protection strategy. EPA and the states have successfully tried some of these approaches, and the 1990 Clean Air Act amendments reflect a willingness on the part of the Congress and the Administration to combine both traditional and market approaches within a single statute. The Project 88 report and other studies have outlined possibilities even beyond those attempted.

Thus far, however, there has been little practical experience in integrating nonregulatory approaches with a regulatory regime, especially at the federal level. Yet information on such experiences would be highly valuable to the Congress and the American public in any efforts to form a more effective control policy. Within the next few years, a number of major environmental statutes are due for reauthorization, including the Clean Water Act and the Resource Conservation and Recovery Act. These events provide EPA a timely opportunity to assist the Congress in making important legislative changes.

We therefore recommend that, in conjunction with the reauthorization of major environmental statutes, the Administrator of EPA work with the Congress to develop legislation that reflects (1) additional opportunities to achieve environmental goals through nonregulatory means, (2) ways in which these methods might complement or replace existing regulations, and (3) the most effective mixture of both approaches.

⁸The Role of Waste Minimization, National Governors' Association State Policy Report (Washington, D.C.: 1989).

Local Financing Requirements Need to Be Addressed

In environmental protection, as in other areas, the federal government has been shifting to state and local governments the authority and responsibility not only for implementing but also for financing major programs. New federal standards for drinking water, solid waste disposal, and wastewater treatment, among others, will require state and local governments to find additional funds to finance needed improvements and to administer and carry out programs.

Much of the financing burden ultimately falls on local governments, since they are the operators and managers of most environmental services. EPA and others have acknowledged that it will be difficult for a number of localities to pay for federally mandated environmental requirements over the next few years. In particular, EPA has projected that between 21 and 30 percent of local governments serving populations of 2,500 or less will need assistance if they are going to maintain the quality of environmental services and comply with legal requirements.

Local Costs to Increase

Costs to all levels of government, as well as the private sector, will increase over the coming decade as a result of broader and more stringent environmental controls. While local governments' share of total costs incurred by all sectors (public as well as private) will remain fairly constant over the next decade, EPA projects that total annualized costs to local governments will increase by almost 70 percent during this period, from \$19 billion in 1987 to over \$32 billion by the year 2000 in constant dollars. Driving these higher costs will be expenditures for wastewater treatment and revisions to several environmental laws in recent years affecting drinking water treatment, sewage sludge disposal, and solid waste disposal.

More stringent environmental requirements have implications for local governments both in terms of capital requirements and increased user charges. Local governments will need additional capital investments to expand and replace or rehabilitate environmental infrastructure, such as water and sewer systems, and they will have to increase household user charges to pay for these improvements.

Capital Investment Requirements

According to a recent EPA analysis, local demand for capital for wastewater treatment plants, solid waste disposal sites, and other environmental facilities could double by the end of the century, increasing from

\$8 billion in 1981 to over \$16 billion in 2000 in constant dollars.¹ New regulations could require another \$3 billion annually in local capital by 2000. Moreover, according to this analysis, future spending may have to be even higher than projected in order to reduce maintenance and rehabilitation backlogs.

The ability to make this investment in environmental infrastructure will be affected by demands for improvement to other infrastructure facilities, including, most notably, the transportation network of highways, port facilities, and airports. However, according to the Office of Technology Assessment, localities may find it easier to obtain financing for transportation improvements through gas taxes and other transportation charges that have been politically acceptable sources of revenue.² Environmental improvements, by contrast, have traditionally depended on federal grants, which, according to a recent analysis by the National Governors' Association (NGA), fell by 67 percent in constant 1988 dollars between 1979 and 1989, decreasing from \$6.8 billion to \$2.3 billion.³ Consequently, more funds for environmental capital needs will have to come from state general revenues, user fees, or specially earmarked taxes.

Users' Costs to Rise

EPA also estimates that, on average, households will have to pay an additional \$100 annually (in 1986 dollars) in user charges and fees for locally provided environmental services.⁴ For municipalities with populations under 2,500, however, the increase will be even higher: \$170 a year. As a percentage of income, expenditures for environmental services will also be greater for households in smaller communities than in larger ones, since smaller municipalities generally have lower average incomes and higher unit costs for improved environmental services. On

¹A Preliminary Analysis of the Public Costs of Environmental Protection: 1981-2000, EPA (Washington, D.C.: May 1990).

²Rebuilding the Foundations: A Special Report on State and Local Public Works Financing and Management, Office of Technology Assessment (Washington, D.C.: 1990).

³Funding Environmental Programs: An Examination of Alternatives, NGA, Natural Resources Policy Studies Unit (Washington, D.C.: 1989). This figure includes grants for state operating budgets and the construction of wastewater treatment plants but does not include Superfund and grants for leaking underground storage tanks.

⁴The Municipal Sector Study: Impacts of Environmental Regulations on Municipalities, EPA (Washington, D.C.: Sept. 1988).

average, households in communities of less than 2,500 will pay 0.7 percent of their incomes for environmental services, as compared with 0.5 percent by households in larger communities.

Some Localities Expected to Have Difficulty Paying

While EPA expects that most municipalities will be able to meet the projected increases in environmental costs, it estimates that between 21 and 30 percent of the more than 26,000 communities with populations of less than 2,500 may have financing difficulties. Problems would occur because of the high costs of some regulations, coupled with the cumulative impact of recent statutory requirements and a limited ability to expand financial obligations.⁵ In addition, several of the more expensive drinking water regulations affect smaller municipalities more than larger ones because the regulations deal with environmental risks that are more often found in smaller water systems. And small, low-income communities may lack the economic base to fund environmental improvements requiring capital investment.

EPA's Efforts to Address Local Financing Needs

Over the last 2 years, EPA has been looking at ways to reduce the cost of meeting environmental requirements and to increase the resources available to meet these needs. EPA's alternative financing initiative, for example, is designed to help local governments find funding sources for environmental projects other than general appropriations or federal grants. EPA has also been examining ways to give local governments greater flexibility in managing their resources and setting environmental priorities.⁶ Both methods have some promise, but in order for them to be fair, as well as effective, in meeting state and local government needs, EPA and the Congress will have to be careful to target efforts to those localities with the greatest needs.

Alternative Financing Mechanisms Helpful but Not Sufficient

According to the 1989 NGA survey, alternative financing mechanisms have been an important source of revenue for state and local governments. The survey concluded, however, that these alternatives will not be sufficient by themselves to pay for current federal environmental requirements.

⁵The Cost of a Clean Environment, p. 9-5.

⁶EPA's other efforts focus on facilitating (1) public-private partnerships (contractual relationships between public and private parties to provide an environmental service), (2) a cooperative approach among industry, academia, states, and local communities, (3) the development of new technologies that help to clean up the environment more efficiently and effectively and (4) pollution prevention (discussed in ch. 4).

NGA defines an alternative financing mechanism as any method used to fund state environmental programs other than federal grants and state general revenues (moneys collected from personal, property, and sales taxes). Alternative financing mechanisms include

- fees, including permit fees, waste generation fees, and waste disposal fees;
- environmental taxes, which are typically levied on pollutants (such as taxes on the discharge of waste) or products that contribute to pollution (such as taxes on the sale of petroleum products);
- bond issues, the major source of funds for large capital projects, such as sewage treatment, water supply, and solid waste facilities;
- revolving loan funds, basically banks operated by the state that are first established by an infusion of seed capital from general appropriations, federal grants, or bond proceeds and then become a source of long-term, low-interest loans to localities for large capital projects;
- compliance penalties and fines; and
- public-private partnerships, or the sharing of private and public resources in the design, financing, construction, ownership, and/or operation of a facility designed to provide a public service.

According to NGA, 44 of the 48 states and territories that reported were using alternative financing mechanisms. They included 272 fee programs, 37 tax programs, 32 bond programs, 19 revolving loan fund programs, and 71 other programs, including fines and penalties. In total, however, these programs contributed only 14 to 19 percent of states' operating budgets for air pollution, water pollution, and hazardous and solid waste control. The rest came from the states' general revenues and federal grants.

The potential for expanding revenues from alternative financing mechanisms appears to be limited, NGA concluded. For one thing, recent changes in tax law have complicated and lessened the attractiveness of private investment in environmental infrastructure. According to NGA, before 1986 state and local governments were able to attract private resources by supplying matching funds through tax-exempt revenue bonds, providing accelerated depreciation schedules, and giving a 10-percent investment tax credit for infrastructure projects. The Tax Reform Act of 1986, however, discouraged private investment by restricting the use of tax-exempt bonds for public projects with more than 10 percent private involvement or benefit, limiting the volume of private-purpose tax-exempt bonds available to each state, repealing the

tax credit, and making the tax allowances for depreciation less attractive for investors. Because tax-exempt bonds accounted for greater revenues than any other alternative financing mechanisms identified in NGA's survey (even with Tax Reform Act restrictions), NGA recommended that current tax law be changed to allow states greater use of bonds to finance joint projects with private parties. A working group of EPA's Environmental Financing Advisory Board is considering the need for legislative and other changes to broaden the availability of tax-exempt financing for state and local environmental facilities.

Even if alternative financing mechanisms could be expanded, however, they clearly will not be able to cover the considerable expenditures that will be required. For example, the amount of money that states raised in 1988 through the use of all alternative financing mechanisms (\$3.2 billion) represents only about 25 percent of just the projected increase—\$13 billion—in local government costs by the year 2000. At our symposium, the Deputy Commissioner for Natural Resources in New York's Department of Environmental Conservation and former Director of the Rhode Island Department of Environmental Management, pointed out that the declining level of environmental services in the Northeast and probably elsewhere in the country due to insufficient financing will not be reversed by alternative financing mechanisms. "The states have exercised a great deal of creativity to look at every possible way of raising money—fees, dedicated trusts, everything you could possibly think of," he said. "[All these alternatives] are not sufficient to do the job."

Legislative and Regulatory Flexibility May Be Needed

EPA's initiative for legislative and regulatory flexibility aims to make environmental laws and regulations fair, effective, flexible, and affordable, taking into consideration the financial impact of these requirements on those who pay. According to EPA's description of the agency's initiative, the agency intends to provide state, local, and private sectors with a greater array of regulatory options and alternatives and to reduce the difficulties of compliance.

EPA recognizes that the effectiveness of its flexibility initiative depends on the agency's having an accurate understanding of the effects of federal environmental requirements on localities. However, in a 1988 analysis of the effect of 22 environmental regulations on municipalities, EPA pointed out that it does not have a consistent method for evaluating the cumulative impact of its programs on those responsible for paying and

suggested that the agency identify the characteristics of small communities that make them more likely to have difficulty paying for new environmental requirements.⁷ EPA also stated that in certain circumstances it might be appropriate to grant certain communities a delay or permanent exemption in meeting federal environmental requirements. According to EPA's The Cost of a Clean Environment report, the agency has also expanded its technical and financial assistance to small communities to help them pay for their capital requirements.

However, in commenting on a draft of this report, agency officials emphasized that this assistance is actually quite limited. They suggested that other federal agencies—such as the Department of Treasury, in terms of tax policy, for example, and the Small Business Administration—have programs and policies that also need to be involved in addressing the environmental financing needs of small communities.

Conclusions and Recommendations

EPA, NGA, and others have all highlighted the need for the federal government to assist state and local governments in finding the additional funds necessary for local governments to implement federal environmental mandates. Not all small communities are expected to face financial difficulties, but without assistance some localities may have to choose between unacceptable alternatives—either to fall into noncompliance with environmental regulations or to give up other important community needs in order to meet these mandates. EPA and the Congress need to know how best to assist the localities that are likely to fall into this group.

We therefore recommend that the Administrator, EPA, report to the Congress on (1) the nature of the costs these localities face in paying for federal environmental requirements, (2) the availability of financing from nonfederal sources for these localities, (3) their expected funding shortfalls after financing from nonfederal sources, and (4) alternatives to reducing these shortfalls, including possible legislative or regulatory relief. Recognizing that the federal role in assisting small communities goes beyond EPA's responsibilities, EPA should work with these other agencies to make sure that federal assistance is properly coordinated and targeted.

⁷See The Municipal Sector Study: Impacts of Environmental Regulations on Municipalities, EPA (Washington, D.C.: Sept. 1988).

List of Symposium Participants (June 6, 1990, Washington, D.C.)

Keynote Remarks

The Honorable Mike Synar, Chairman, Environment, Energy and Natural Resources Subcommittee, House Committee on Government Operations

Panel Discussion

Moderator

J. Dexter Peach, Assistant Comptroller General, GAO

Panelists

Robert L. Bendick, Deputy Commissioner for Natural Resources, New York Department of Environmental Conservation

Richard Frandsen, Counsel, House Committee on Energy and Commerce

Peter F. Guerrero, Associate Director, Environmental Protection Issues, GAO

Michael Gough, Director, Center for Risk Management, Resources for the Future¹

F. Henry Habicht II, Deputy Administrator, Environmental Protection Agency

Richard L. Hembra, Director, Environmental Protection Issues, GAO

Joan Martin-Brown, Washington Office Director, United Nations Environment Programme

W. Roger Strelow, Vice President, Bechtel Environment Corporation

¹Now with the Office of Technology Assessment.

Major Laws Administered by EPA

Law	Purpose/regulatory action
Clean Air Act, as amended	Protect and enhance air quality in order to promote public health and welfare
Federal Water Pollution Control Act Amendments of 1972, as amended (Clean Water Act)	Restore and maintain the chemical, physical, and biological integrity of the nation's waters
Safe Drinking Water Act, as amended	Protect the quality of all sources of drinking water—surface and groundwater
Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (Superfund)	Respond to releases of hazardous substances
Federal Insecticide, Fungicide, and Rodenticide Act, as amended	Regulate the distribution, sale, and use of pesticides
Resource Conservation and Recovery Act of 1976, as amended	Regulate the generation, transportation, treatment, storage, and disposal of hazardous wastes
Toxic Substances Control Act of 1976, as amended	Require testing and, if necessary, restrictions on chemical substances
Marine Protection, Research, and Sanctuaries Act of 1972, as amended	Regulate the dumping of all materials into oceans and prevent or strictly limit the dumping of material that adversely affects human health or the marine environment
National Environmental Policy Act of 1970	Require EPA to review environmental impact statements
Environmental Research, Development, and Demonstration Authorization Acts	Authorize appropriations for various EPA research programs

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Related GAO Products

The Budget Deficit: Outlook, Implications, and Choices (GAO-OCG-90-5, Sept. 12, 1990).

Cost-Benefit Analysis Can Be Useful in Assessing Environmental Regulations, Despite Limitations (GAO/RCED-84-62, Apr. 6, 1984).

Environmental Protection Agency: Protecting Human Health and the Environment Through Improved Management (GAO/RCED-88-101, Aug. 16, 1988).

Creation of a Department of the Environment (GAO/T-RCED-90-26, Feb. 8, 1990).

Creation of a Department of Environmental Protection (GAO/T-RCED-90-25, Feb. 7, 1990).

A Market Approach to Air Pollution Control Could Reduce Compliance Costs Without Jeopardizing Clean Air Goals (GAO/PAD-82-15, Mar. 23, 1982).

Observations on the Environmental Protection Agency's Budget Request for Fiscal Year 1991 (GAO/T-RCED-90-46, Mar. 7, 1990).

Observations on the Environmental Protection Agency's Budget Request for Fiscal Year 1992 (GAO/T-RCED-91-14, Mar. 7, 1991).

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