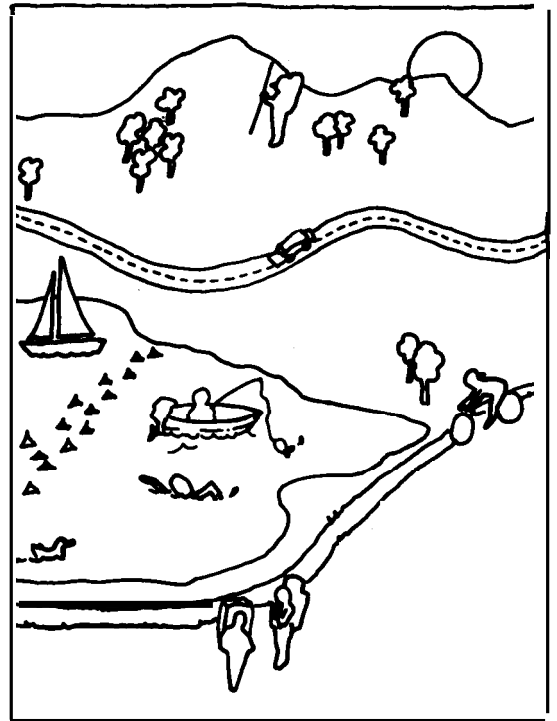
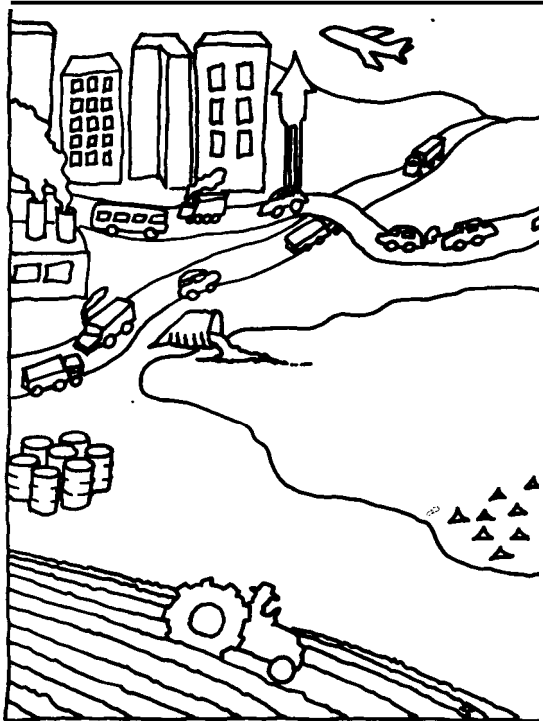




EPA's Use of Benefit -Cost Analysis: 1981-1986



EPA's Use of Benefit-cost Analysis

1981-1986

By

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Acknowledgments

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUN 11 1987

OFFICE OF
POLICY, PLANNING AND EVALUATION

MEMORANDUM

SUBJECT: Report entitled "EPA's Use of Benefit-Cost Analysis:
1981-1986"

FROM: John M. Campbell *J. M. Campbell*
Acting Assistant Administrator for OPPE

THROUGH: A. James Barnes
Deputy Administrator

TO: Lee M. Thomas
Administrator

I am pleased to forward the enclosed report, "EPA's Use of Benefit-Cost Analysis: 1981-1986." This report, prompted by an initial GAO analysis, discusses the contributions that benefit-cost analysis has made to EPA'S regulatory process and examines the limitations of benefit-cost analysis as well. It analyzes the various statutory provisions that affect EPA's use of these analyses in regulatory decision making. Finally, it describes how EPA is working to improve its benefit-cost analyses in the future.

In addition to the benefit-cost analyses prepared for major rules as part of the RIA process, EPA prepares benefit-cost analyses to accompany most other important environmental decisions. During the 5-year period covered by this report, EPA issued about 1,000 regulations. Less than 2% of these were considered major rules requiring RIAs. EPA prepared RIAs for 15 of the 18 major rules. The other 3 were exempted by OMB because of statutory or court-imposed deadlines. The accompanying report covers the benefit-cost analyses prepared for each of the 15 RIAs, as well as several of the analyses prepared for non-major rules.

The major findings of our study are the following:

1. Analysis improves environmental regulation.

EPA's benefit-cost analyses have resulted in several cases of increased net benefits to society from environmental regulations. Three of the RIAs showed that the net benefits from

recommended improvements in the regulations would exceed \$10 billion. The total cost of preparing all of the 15 RIAs studied was approximately \$10 million. Thus, our analyses yielded a return on investment of 1,000 to 1.

2. Benefit-cost analysis often provides the basis for stricter environmental regulations.

Environmentalists often fear that economic analysis will lead to less strict environmental regulations in an effort to save costs, but our study reveals that the opposite is just as often the case. For example, the most dramatic increase in net benefits (\$6.7 billion) from EPA's RIAs resulted from a recommendation for much stricter standards – to eliminate lead in motor fuels.

3. Alternatively, benefit-cost analysis may reveal regulatory alternatives that achieve the desired degree of environmental benefits at a lower cost.

Four of the analyses studied (used oil, TSCA premanufacture review, FIFRA data requirements, and the national contingency plan) showed how less costly regulations would achieve results equivalent to the more expensive alternatives. In two of these cases (used oil and the national contingency plan), the analyses showed that the less costly alternatives would lead to greater reductions in environmental risk.

4. Statutory restrictions limit EPA's use of benefit-cost analysis for many regulations.

Many environmental statutes prevent EPA from considering costs and even some benefits when setting environmental standards. EPA was able to consider the full implications of its benefit-cost analyses when setting only 6 of the 15 regulations studied. EPA's experience shows, however, that some of the traditional statutory decision criteria, such as "health effects thresholds" and "technical feasibility," frequently do not provide clear distinctions for decision making. Being able to consider the full range of benefits and costs associated with alternative standards would enhance the information available in making these decisions.

5. The average cost of an RIA is low.

The average cost of EPA's 15 RIAs was \$685,000. This amounts to about 0.1% of the minimum cost of a major rule over five years. (By definition, a major rule has a cost of at least \$100 million per year.)

6. EPA can improve its benefit-cost analyses by expanding the available scientific and economic database and by following more rigorously EPA's own guidelines for preparing RIAs.

Only 6 of the 15 benefit-cost analyses presented a complete analysis that included monetized estimates of the net benefits of regulatory alternatives. For many of these analyses, the necessary scientific and/or economic data were either inadequate or unavailable. In the case of some of the other analyses, on the other hand, EPA simply did not thoroughly carry out all of the specific types of analyses called for in the RIA guidelines.

Over the years since EPA was founded, EPA's use of benefit-cost analysis in environmental rulemaking has increased considerably. While recognizing the limitations of benefit-cost analyses, we are finding these analyses to be increasingly useful tools in helping to provide the

balance required in complex regulatory decisions. We expect that this report, which we will publish with limited distribution, will contribute to a better understanding on the part of EPA, the regulated community, and the nation as a whole of the role of these analyses in environmental rulemaking.

EPA's Use of Benefit-cost Analysis
1981 -1986
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NAAQS for Particulate Matter b
Surface Coal Mines c
Heavy Duty Motor Vehicles d
NAAQS for Carbon Monoxide e
Lead in Fuels f
Iron and Steel g
Organic Chemicals h
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Executive Summary

EPA's central mission is to carry out its various statutory directives to protect the nation's health, welfare, and environment from the risks posed by pollution. Because the nation's resources are limited, EPA seeks to the extent legally permitted to direct those resources towards the actions that will produce the greatest reductions in environmental risk. Benefit-cost analysis is one of the analytic tools that the Agency uses to help make these environmental decisions.

Over the past 15 years, EPA's use of benefit-cost analysis in its rulemaking activity has increased considerably. This evolution has been driven in part by a series of executive orders requiring regulatory analyses, and in part by a steady improvement in the analytic techniques and data sources available to the Agency. The increasingly detailed and comprehensive benefit-cost analyses have contributed to a better understanding, on the part of EPA, the regulated community, and the nation as a whole, of the benefits and costs of environmental regulations.

On April 6, 1984, the U.S. General Accounting Office (GAO) published a review of three of EPA's Regulatory Impact Analyses (RIAs) entitled "Cost-Benefit Analysis Can Be Useful in Assessing Environmental Regulations, Despite Limitations" (GAO Report). The GAO report offered several recommendations for enhancing the usefulness of benefit-cost analysis in the regulatory process. Among these recommendations was that EPA send to the Congress, "in executive summary form, those cost-benefit analyses that cannot be used in environmental rulemaking because of legal restrictions."

This report, prompted in part by the GAO report, examines the contributions that benefit-cost analyses have made and discusses their limitations as well. It analyses the various statutory provisions that affect EPA's use of benefit-cost analysis in regulatory decision making. Finally, it describes how EPA is working to improve its benefit-cost analyses in the future. Included in the appendix are executive summaries of each of the 15 benefit-cost analyses discussed in this report.

Historical Background

EPA has been preparing analyses of environmental regulations since its inception. EPA has prepared these analyses both to provide information essential to fulfilling its statutory responsibilities and also to comply with executive orders. Each of the major environmental statutes designates different factors that EPA is to consider when setting environmental regulations. At the same time the Agency is required to provide regulatory analyses for review

by the Office of Management and Budget (OMB). Beginning with the “Quality of Life” reviews under the Nixon Administration, the requirements for review by OMB have evolved from a relatively simple analysis of costs to the comprehensive benefit-cost analyses required for the current Regulatory Impact Analyses. Often, the factors required for review by OMB are not the same as those specified for consideration in the environmental statutes.

The U.S. Environmental Protection Agency is authorized to issue regulations under several different Acts of Congress. Some of these laws give EPA relatively broad flexibility when choosing which factors to consider in the decision making process. With other laws, however, the scope of EPA’s consideration is more narrowly defined by the enabling legislation. Although none of the environmental statutes specify an analysis of net benefits as part of the rulemaking process, many statutes direct EPA to consider most, if not all, of the information that results from preparing benefit-cost analyses.

President Reagan’s Executive Order 12291 of 1981 requires agencies to prepare Regulatory Impact Analyses (RIAs) for most major regulations. Executive Order 12291 is the first such order to designate “net benefits” as the criterion for assessing proposed regulations. In the words of the executive order, “regulatory objectives shall be chosen to maximize the net benefits to society,” and “regulatory action shall not be undertaken unless the potential benefits to society for the regulation outweigh the potential costs to society.”

By using the phrase “to the extent permitted by law” to qualify the directive that agencies consider the RIAs in their rulemaking, Executive Order 12291 recognizes that there are many instances in which Congress has directed an agency to base its rulemaking on considerations other than those of maximizing net benefits.

EPA’s Benefit-cost Analyses, 1981-1986

Executive Order 12291 requires EPA to prepare RIAs only for major rules, a very small portion of EPA’s rulemaking activity. Less than two percent of the approximately 1,000 regulations issued by EPA from 1981 through 1985 were considered major rules. From February 1981 through February 1986, the period covered by this report, EPA issued 18 major rules as proposed and/or final rules. The Agency prepared RIAs for 15 of these rules. OMB exempted the other three major rules from the RIA requirements. In addition to the RIAs for major rules, EPA prepared benefit-cost analyses for many non-major rules and environmental decisions.

Although the benefit-cost analyses in each of the RIAs included monetized cost estimates and discussed the benefits of the regulations, not every benefit-cost analysis included monetized estimates of benefits. In general, the benefit-cost analyses prepared for air and water regulations were more likely to include monetized benefits estimates than those for other program areas. This is because the data and analytic techniques necessary for the analysis of pollutant quantities, exposures, and adverse effects are available more often for air and water regulations than for some of the other regulations. Twelve of the benefit-cost analyses included estimates of changes in exposure and/or reductions in adverse effects projected as a result of regulatory actions. Six of these analyses traced benefit estimates completely from improved ambient conditions through

reduced exposures and adverse effects to estimates of the monetized values of the benefits and net benefits of the regulations.

These six analyses provided EPA with direct comparisons of the benefits and costs of regulatory alternatives. Two of these analyses (lead in fuels and NAAQS-PM) showed that more stringent standards could lead to greater benefits for society. One analysis (surface coal mines) showed that costs would exceed benefits for two of the three alternatives proposed. Another (organic chemicals) revealed hitherto unnoticed inter-media pollution effects that EPA is now taking into consideration. The remaining two analyses (iron and steel and PCBs) confirmed the positive net benefits of the preferred regulatory alternatives.

The analyses that did not monetize net benefits typically evaluated regulatory alternatives on the basis of cost per cancer case avoided, cost per ton of pollutant removed, or similar cost-effectiveness measures. Although these analyses might be more appropriately termed cost-effectiveness analyses, they are included in this report under the more general heading of benefit-cost studies, because they compared quantified benefits with monetized costs.

Although these analyses did not provide EPA with directly comparable estimates of benefits and costs, they were useful in showing the relationships between benefits, however measured, and costs. Two of these analyses (used oil and national contingency plan) assisted EPA in selecting regulatory alternatives that will result in greater environmental benefits at less cost. Another (TSCA premanufacture review) showed how the costs of the regulation could be reduced considerably with no significant reduction in benefits. A fourth analysis (small quantity generators), on the other hand, showed that greater benefits could be achieved with only a small increase in costs.

Contributions of Benefit-cost Analysis

Among the many ways that benefit-cost analyses have influenced the development of regulations at EPA are the following:

1. Guiding the regulation's development,
2. Adding new alternatives,
3. Eliminating non-cost-effective alternatives,
4. Adjusting alternatives to account for differences between industries or industry segments,
5. Supporting decisions.

At times benefit-cost analysis has led to more efficient regulations by showing how more stringent alternatives would bring about a greater reduction in pollution without a commensurate increase in costs. In two instances (leads in fuels and small quantity generators) this led to the adoption of regulations that were more stringent than originally contemplated. At other times the analysis showed that the costs of more stringent regulations would be disproportional to the expected benefits. In three instances (used oil, TSCA premanufacture review, FIFRA data requirements) this led to the selection of less stringent regulatory alternatives that resulted in reduced regulatory burdens without significant reductions in environmental improvement.

While these improvements cannot be attributed solely to benefit-cost analysis, it is fair to say that the analyses played major roles in bringing about the regulatory improvements. The most dramatic potential increases in the estimated net benefits from regulation are summarized as follows:

RIA	Change in Regulation	Potential Increase Total Net Benefits of Regulations
Lead in Fuels	more stringent standard, greater health and welfare benefits	\$6.7 billion
Used Oil	reduced regulatory costs, greater reduction in risk	\$3.6 billion
Premanufacture Review	reduced regulatory costs, no significant reduction in effectiveness	\$40 million

The contributions of the benefit-cost analyses prepared by EPA go beyond individual regulations, however. In addition to improving individual environmental regulations, benefit-cost analyses also have increased awareness of the environmental results of EPA's regulations, provided a framework for comparing regulations both within a single medium and across media, identified cross-media effects, and improved analytic techniques.

Costs of the Analyses

One issue frequently raised about the RIA process is the cost and time required to perform the benefit-cost and other analyses required for the RIAs. The total cost of the twelve RIAs for which cost information is available was approximately \$8.1 million. The cost of each RIA ranged from \$210,000 to \$2,380,000, with an average cost of approximately \$675,000.

When compared with the costs of at least \$100 million per year that are associated with each major regulation, a one time cost of less than \$1 million for each benefit-cost analysis seems modest. As EPA's experience demonstrates, benefit-cost analyses have often played major roles in bringing about regulatory improvements worth many times the cost of the analyses. The benefit-cost analyses summarized in this report cost approximately \$10 million but were instrumental in bringing about regulatory improvements estimated at over \$10 billion. This would be equivalent to a return on investment of over 1,000 to 1.

Limitations of Benefit-cost Analysis

Benefit-cost analysis and the RIA process have been subject to considerable scrutiny since Executive Order 12291 was issued. The GAO report pointed to a number of limitations in the three analyses it reviewed, and a number of subsequent journal articles have addressed the subject.

In general, there are three major types of limitations discussed in these reviews:

1. Those inherent in the nature of economic analyses in general,
2. Those caused by gaps in available information and deficiencies in analytic techniques, and
3. Those that are the result of errors and omissions in the execution of the analysis.

EPA recognizes the importance of these limitations, addressed more fully in the body of this report, and has taken them into consideration in the Agency's guidelines for preparing RIAs.

Directions for the Future

Benefit-cost analysis has proven to be a useful tool not only for comparing alternatives for a specific regulation, but also for comparing the relative value of the many different regulations that are written in response to EPA's various statutory authorities. Through such analyses EPA is increasing its ability to decide how to apply the nation's limited resources to achieve greater levels of environmental protection, not only within but across environmental media.

As the Agency's economic analytical capability has advanced, EPA has begun to discover limitations in some of the traditional decision criteria for setting standards. EPA's experience shows that these decision criteria, such as "health effects thresholds," "margins of safety," and "technical feasibility," frequently do not provide clear distinctions for decision making. Increasingly, health effects research is finding that it is difficult to identify thresholds below which certain pollutants pose no risk of adverse health effects. At the same time, engineering advances are resulting in technologies that can achieve lower and lower levels of pollution, albeit usually at higher and higher costs. When there are no identifiable health effects thresholds and no limits to control technology, then choosing an appropriate level of control becomes a matter of balancing the relative benefits and costs of additional levels of control.

While recognizing the limitations of analyses such as benefit-cost analyses, EPA finds these analyses to be increasingly useful tools in helping to provide the balance required in complex regulatory decisions. Consequently, EPA is committed to strengthening its capabilities for performing benefit-cost analyses and to improving the research programs that provide the underlying economic, scientific, and technical information.

Chapter 1

Introduction

EPA's central mission is to carry out its various statutory directives to protect the nation's health, welfare, and environment from the risks posed by pollution. Because the nation's resources are limited, EPA seeks to the extent legally permitted to direct those resources toward the actions that will produce the greatest reductions in environmental risk. Benefit-cost analysis is one of the analytic tools that the Agency uses to help make these environmental decisions.

Over the past 15 years, EPA's use of benefit-cost analysis in its rulemaking activity has increased considerably. This evolution has been driven in part by a series of executive orders requiring regulatory analyses, and in part by a steady improvement in the analytic techniques and data sources available to the Agency. The increasingly detailed and comprehensive benefit-cost analyses have contributed to a better understanding, on the part of EPA, the regulated community, and the nation as a whole, of the benefits and costs of environmental regulations.

EPA's recent benefit-cost analyses have been prepared under Executive Order 12291, issued in February 1981. This is the first executive order to provide a formal mechanism for comparing the benefits and costs of environmental regulations. It requires each federal agency to prepare a Regulatory Impact Analysis (RIA) to accompany most major rules. Each RIA should include a complete analysis of the benefits and costs associated with regulatory alternatives and should calculate the net benefits of each alternative.

The benefit-cost analyses contained in each RIA fulfill multiple objectives. They articulate how pollution damages human health, welfare, and the environment. They estimate the benefits of reducing those damages. They estimate the costs of pollution control and the cost-effectiveness of control alternatives. And they assess the impacts of pollution control alternatives upon business, society, and the economy.

Benefit-cost analyses are based upon scientific research of the extent and the effects of pollution and upon engineering studies of alternative pollution control technologies. Although monetizing the costs of control is usually routine, monetizing the benefits of environmental improvements is more complex. Typically, the benefits are based upon "willingness-to-pay" estimates obtained from the revealed preferences of potentially affected individuals. These estimates use the common metric of the dollar to answer the question: What is the value placed on a change in well-being that results from an improvement in environmental quality? Estimates of the net benefits of each regulatory alternative are obtained by subtracting the estimated costs from the estimated benefits.

For each regulatory alternative, the RIAs should include not only estimates of those benefits and costs that can be monetized, but also descriptions of health and environmental benefits that cannot be monetized. These analyses should be accompanied by qualifications as to the accuracy

of the analyses and uncertainties in the estimates, and comments on intergenerational and other distributional considerations. The benefit-cost analyses in the RIAs are used to assess how environmental regulations fulfill environmental, economic, and social objectives.

EPA strives simultaneously to provide the full benefit-cost analyses required by Executive Order 12291, and to remain faithful to its statutory directives. Many of the statutes that govern EPA define which benefit and cost factors it may consider when deciding upon regulations. When setting standards under these statutes, EPA prepares full regulatory impact analyses, but the Administrator considers only those portions of the analyses that the statute allows.

While recognizing these limitations, the U.S. General Accounting Office (GAO) has praised benefit-cost analysis as a valuable tool for improving environmental regulations. On April 6, 1984, the GAO published a report on three of EPA's RIAs entitled *Cost-Benefit Analyses Can Be Useful in Assessing Environmental Regulations, Despite Limitations*.¹ The GAO report offered several recommendations for enhancing the usefulness of benefit-cost analysis in the regulatory process. Among these recommendations was that EPA send to the Congress, "in executive summary form, those cost-benefit analyses that cannot be used in environmental rulemaking because of legal restrictions."²

For the first five years following the issuance of Executive Order 12291, EPA prepared 15 RIAs to accompany major rules and many similar analyses to accompany a number of non-major rules. This report, prompted in part by the GAO report, examines the contributions that benefit-cost analyses have made and discusses their limitations as well. It analyses the various statutory provisions that affect EPA's use of benefit-cost analysis in making regulatory decisions. Finally, it describes how EPA is working to improve its benefit-cost analyses for the future. The appendix contains executive summaries of each of the RIAs prepared by EPA for major rules from February 1981 when Executive Order 12291 was issued through February 1986.

Chapter 2

Historical Background

EPA has been preparing analyses of environmental regulations since its inception, both to provide information essential to fulfilling its statutory responsibilities and also to comply with executive orders. Each of the major environmental statutes designates different factors that EPA is to consider when setting environmental regulations. At the same time, EPA must provide regulatory analyses for review by the Office of Management and Budget (OMB). Beginning with the “Quality of Life” reviews under the Nixon Administration, the requirements for review by OMB have evolved from a relatively simple analysis of costs to the comprehensive benefit-cost analyses required for the current RIAs. Often, the factors required for review by OMB are not the same as those specified for consideration in the environmental statutes.

This chapter examines how the requirements for regulatory analysis have evolved and describes the requirements of Executive Order 12291. Chapter 3 discusses how these requirements compare with those of EPA’s enabling legislation.

Precursors of RIAs

Over the years, the scope of the regulatory analyses required by executive orders has gradually broadened to include not only costs, but also inflation and other economic impacts, effects on small businesses, benefits, and net benefits. Table 2-1 summarizes the history of these regulatory analysis requirements.

Quality of Life Review

The first executive requirement for came shortly after EPA was formed. On October 5, 1971, OMB established a formal an economic analysis of EPA’s regulations review procedure for regulations pertaining to environmental quality, consumer protection, and occupational and public health and safety. Known as the “Quality of Life” review, it required that a “summary description” accompany every significant regulation, indicating the principal objectives of the regulation, the alternatives considered, a comparison of the benefits and costs associated with the alternatives, and the reasons for selecting the proposed alternative.¹

Table 2-1

History of Regulatory Analysis

<u>Act/Executive Order</u>	<u>Year</u>	<u>Title of Analysis</u>	<u>Types of Analysis</u>
OMB Memo 10/5/71	1971	Quality of Life Review	Costs, Benefits
Executive Order 11821	1974	Inflation Impact Statement	Costs, Benefits Inflationary Impacts
Executive Order 11949	1976	Economic Impact Statement	Costs, Benefits, Economic Impacts
Executive Order 12044	1978	Regulatory Analysis	Costs, Economic Consequences
Regulatory Flexibility Act	1980	Regulatory Flexibility Analysis	Impacts on Small Businesses
Executive Order 12291	1981	Regulatory Impact Analysis	Costs, Benefits, Net Benefits

Inflation Impact Statements

President Ford's Executive Order 11821 of November 27, 1974, required all major regulations to be accompanied by a statement "certifying that the inflationary impact of the proposal has been evaluated." These statements were referred to as "Inflation Impact Statements."²

In January 1975, OMB required each agency to develop criteria for determining which rules would be considered major, as well as procedures for evaluating the inflationary impact of proposed rules. OMB specified that these statements were to include (1) a review of the alternatives to the proposed action, together with their probable costs, benefits, risks, and inflationary impacts; (2) the costs associated with the recommended alternative, together with the inflationary effects of the action on markets, consumers, and businesses; and (3) a comparison of the benefits to be derived from the proposed action, with the estimated costs and inflationary impacts. Costs, benefits, and economic impacts were to be quantified as much as possible.³

EPA responded to OMB'S directive by adopting final guidelines for Inflation Impact Statements in April 1975. These guidelines required the analysis of the costs, benefits, risks, and inflationary impacts of the proposed action and its alternatives. EPA emphasized that the benefits were to be expressed first in terms of environmental improvements, and were to be valued in dollar terms where feasible. However, EPA did point out in its guidelines that "given the limitations in the state of the art of benefits assessment of pollution control, ...in most cases this type of valuation will not be feasible or meaningful."⁴ Thus, although a discussion of benefits and a comparison of benefits with costs were called for in OMB'S guidance, the emphasis of Inflation Impact Statements was upon costs and the impact of those costs on the economy.

Economic Impact Statements

Executive Order 11821 expired at the end of 1976. On December 31, 1976, President Ford issued Executive Order 11949, extending the previous order for another year. This new order also changed the title of the required analyses to that of "Economic Impact Statements."⁵ In January 1977, EPA revised its guidelines for these analyses. The new guidelines recommended that the title of the analyses be amended to "Economic Impact Analyses" (EIAs) to avoid confusion with Environmental Impact Statements (EISs).⁶ This new title was adopted by EPA, but was never formalized by the executive office.

Regulatory Analysis

In March 1978, President Carter's Executive Order 12044 replaced the Economic Impact Statement with the Regulatory Analysis. The Regulatory Analysis was to contain a "succinct statement of the problem; a description of the major alternative ways of dealing with the problem that were considered by the agency; an analysis of the economic consequences of each of these alternatives, and a detailed explanation of the reasons for choosing one alternative over the others." Consideration of benefits was not an explicit requirement of the analysis, but the

agencies were required to consider “the direct and indirect effects of the regulation,” and to choose the “least burdensome” alternative.

EPA responded to Executive Order 12044 by publishing final guidelines for implementation in May 1979. The contents of the Regulatory Analyses were to include marginal cost-effectiveness curves for each alternative, together with analyses of the economic impacts of the proposed standard and of each alternative. An analysis of the environmental improvements and other benefits of the proposed action was not required by Executive Order 12044 and, accordingly, was not included in EPA’s guidelines for Regulatory Analyses.⁸

Regulatory Flexibility Analysis

The Regulatory Flexibility Act in 1980 added another report to the requirements for regulatory development. It required all federal agencies to analyze the impacts of proposed regulations on small businesses, small nonprofit organizations, and small governmental entities. A Regulatory Flexibility Analysis is required for all actions, except those that will “not have a significant economic impact on a substantial number of small entities.”⁹

Regulatory Impact Analyses

President Reagan’s Executive Order 12291 of 1981 replaced the Regulatory Analysis with the Regulatory Impact Analysis. The RIA not only restored the consideration of benefits to the regulatory process; but also subtly changed the emphasis of regulatory development. No longer were agencies to choose the “least burdensome” alternative. Instead, they were directed to choose the alternative that would maximize the “net benefits to society.”¹⁰

As of the date of this report, all federal agencies must prepare RIAs for most major regulations and Regulatory Flexibility Analyses, except when the Administrator, certifies there will be no significant economic impact on small entities. These two analyses may be combined into one report.

Executive Order 12291 is the first such order to designate “net benefits” as the criterion for assessing proposed regulations. In the words of the executive order, “Regulatory objectives shall be chosen to maximize the net benefits to society,”¹¹ and “Regulatory action shall not be undertaken unless the potential benefits to society for the regulation outweigh the potential costs to society.”¹² Executive Order 12291 recognizes that many environmental statutes have established other criteria for setting regulations and qualifies its directive to maximize net benefits with the phrase “to the extent permitted by law.”

Definition of “Major Rule”

To ensure that its requirements are carried out, Executive Order 12291 requires each agency to prepare and, to the extent permitted by law, consider an RIA for every major rule. A major rule is defined as any regulation that is likely to result in (1) an annual effect on the economy of \$100 million or more; (2) a major increase in costs or prices; or (3) significant adverse effects on

competition, employment, investment, productivity, innovation, or the international competitive position of U.S. firms.

Regulations Exempt from RIAs

The executive order provides for certain exemptions to the RIA process. Regulations that respond to emergencies are exempt from the review schedules, but RIAs are required as soon as is practicable. Regulations for which the RIA process would conflict with deadlines imposed by statute or by judicial order are similarly exempt, but the RIA requirements must be followed to the extent permitted by statutory or judicial deadlines. Finally, the Director of OMB may exempt any class or category of regulations from any or all of the requirements, subject to the direction of the Task Force on Regulatory Relief.

Required Contents

As specified in Executive Order 12291, the contents of each RIA must include:

1. “A description of the potential benefits of the rule, including any beneficial effects that cannot be quantified in monetary terms, and the identification of those likely to receive the benefits;
2. “A description of the potential costs of the rule, including any adverse effects that cannot be quantified in monetary terms, and the identification of those likely to bear the costs;
3. “A determination of the potential net benefits of the rule, including an evaluation of effects that cannot be quantified in monetary terms;
4. “A description of alternative approaches that could substantially achieve the same regulatory goal at lower cost, together with an analysis of the potential benefits and costs and a brief explanation of the legal reasons why such alternatives, if proposed, could not be adopted; and
5. “Unless covered by the description required under paragraph (4) of this subsection, an explanation of any legal reasons why the rule cannot be based on the requirements set forth in Section 2 of this Order.”¹³

Although Executive Order 12291 does not explicitly require an analysis of the benefits or costs of all of the alternatives to the proposed action, such analysis is implicit in the requirement that the alternative with the greatest net benefits be chosen.

OMB Guidelines

In June 1981, OMB issued guidance to help federal agencies prepare RIAs. The guidance elaborates the requirements of the executive order. Unlike the executive order, however, it explicitly calls for estimates of the benefits, costs, and net benefits of all major regulatory alternatives.¹⁴

EPA Guidelines

In December 1983, EPA issued its own final guidelines for performing RIAs.¹⁵ These guidelines expand on OMB'S guidance, especially on the statement of the need for and consequences of the proposal, the examination of alternative approaches, the analysis of benefits and costs. EPA's guidelines are divided into six sections are supplemented with four appendices and two additional guidance documents.

The six sections are:

1. schedules for OMB review,
2. stating the need for and consequences of the proposal,
3. considering alternative approaches,
4. assessing benefits,
5. analyzing costs, and
6. evaluating benefits and costs.

The first section sets forth OMB'S analytical requirements and its schedule for regulatory review. The remaining sections describe how the RIA is to be performed. Appendices have been drafted to provide considerably more detail on analyzing benefits; analyzing costs, choosing discount rates, and performing economic impact analyses. Additional guidance documents have been drafted to provide information on how to value mortality and morbidity benefits, and case studies have been prepared as examples of well prepared analyses. The guidelines, appendices, and associated documents are intended to reflect the state of the art in analytic techniques and are updated regularly.

Chapter 3

Legislative Authorities Affecting Benefit-cost Analysis

By using the phrase “to the extent permitted by law” to qualify the directive that agencies consider the RIAs in their rulemaking, Executive Order 12291 recognizes that there may be instances in which Congress has directed an agency to base its rulemaking on considerations other than those of maximizing net benefits.

The U.S. Environmental Protection Agency is authorized to issue regulations under several different acts of Congress. These include the Clean Air Act; the Clean Water Act; the Safe Drinking Water Act; the Toxic Substances Control Act; the Resource Conservation and Recovery Act; the Comprehensive Environmental Response, Compensation and Liability Act; the Federal Insecticide, Fungicide, and Rodenticide Act; and the Atomic Energy Act and its amendments, including the Uranium Mill Tailings Radiation Control Act.

Some of these laws give EPA relatively broad flexibility when choosing which considerations to include in the decision-making process. With other laws, however, the scope of EPA’s consideration is more narrowly defined by the enabling legislation. The following paragraphs summarize EPA’s legislative authorities and discuss the extent to which EPA is able to consider the results of its benefit-cost analyses in its rulemaking under each act. Table 3-1 summarizes how the analyses permitted under these acts compare with the benefit-cost analyses required under Executive Order 12291. As can be seen, although none of the environmental statutes specifies an analysis of net benefits as part of the rulemaking process, many statutes direct EPA to consider most, if not all, of the benefit and cost analyses that are part of determining net benefits.

Clean Air Act

The Clean Air Act (CAA) requires EPA to issue many different types of regulations for different types of emission sources.¹ Depending on the source and pollutant, the Act places different requirements on the rulemaking process. For some regulations, such as the primary National Ambient Air Quality Standards (NAAQS), the statute explicitly speaks only of effects of the regulation upon public health. For others, such as most emission standards for motor vehicles and aircraft, the CAA calls for analysis of the cost of compliance. For the regulation that controls or prohibits motor vehicle fuels, the CAA specifically requires a benefit-cost analysis whenever the regulation is intended to protect the effectiveness of emission control systems.

Table 3-1

Analyses Specified in EPA's Enabling Legislation

Act/Regulation	Benefits			Costs		
	Pollution Reduction	Health	Welfare/Envrnmnt	Compliance Costs	Cost Effctv	Economic Impacts
Clean Air Act						
NAAQS - Primary	X					
NAAQS - Secondary			X			
Hazardous Air Pollutants		X				
New-Source Standards	X	*	*	**	**	**
Motor Vehicle Standards***	X	X	X	X	X	X
Aircraft Emissions	X	X	X	X		X
Fuel Standards***	X	X	X	X		
Clean Water Act						
Private Treatment Works	X		****	X	X	X
Public Treatment Works	X					
Safe Drinking Water Act						
Max. Contaminant Level Goals		X				
Maximum Contaminant Levels				X		X
Toxic Substances Control Act	X	X	X	X	X	X
Resource Conservation and Recovery Act		X	X			
Comprehensive Environmental Response, Compensation and Liability Act						
Reportable Quantities		X	X			
National Contingency Plan	X				X	
Federal Insecticide, Fungicide, and Rodenticide Act						
Data Requirements			X			
Minor Uses	X	X	X	X	X	X
Atomic Energy Act						
Radioactive Wastes	X	X	X			
Uranium Mill Tailings	X	X	X	X	X	X

* Includes non-air-quality health and environmental impacts only.

** Statute refers only to "cost."

*** Type of analysis depends on grounds for control.

**** Includes non-water-quality environmental impacts only.

Many of the air pollution regulations for stationary sources are governed by public health and welfare considerations. EPA must base the primary NAAQS upon air quality criteria and must allow an “adequate margin of safety ...requisite to protect the public health.”² In setting these regulations, the CAA specifies only that EPA shall consider public health. EPA has not considered any analyses that evaluate costs or nonhealth benefits. Thus, EPA has considered part, but not all, of the benefit-cost analyses for these regulations.

The language for the secondary NAAQS allows the consideration of a broader range of analyses. EPA must establish the secondary NAAQS “to protect the public welfare from any known or anticipated adverse effects.”³ Effects on welfare are defined in the Act as including, but not being limited to, “effects on soils, water, crops, vegetation, man-made materials, animals, wildlife, weather, visibility, and climate, damage to and deterioration of property, and hazards to transportation, as well as effects on economic values and on personal comfort and well-being.”⁴

The National Emission Standards for Hazardous Air Pollutants (NESHAPs) must be set at the level that “provides an ample margin of safety to protect the public health....”⁵ EPA does consider costs and economic feasibility to a limited extent when setting these standards.

In establishing the performance standards for new stationary sources of pollution, EPA is required to consider costs. EPA must choose a standard that reflects “the degree of emission reduction achievable through the application of the best system of continuous emission reduction which (taking into consideration the cost of achieving such emission reduction, and any non-air quality health and environmental impact and energy requirements)...has been adequately demonstrated ...”⁶ This language explicitly calls for the consideration of costs, but omits any reference to air quality benefits. Consequently, EPA considers costs, cost-effectiveness and economic impacts in setting these standards, because cost-effectiveness exclusively considers costs in relation to emission reduction. It does not consider air-quality-related benefits when setting these standards.

While establishing emission standards for motor vehicles, EPA generally must consider costs. For example, certain heavy duty motor vehicle standards are to “reflect the greatest degree of emission reductions achievable...giving appropriate consideration to the cost of applying such technology within the period of time available...and to noise, energy, and safety factors associated with the application of such technology.”⁷ Certain other heavy-duty standards may be revised, if they “cannot be achieved...without increasing cost or decreasing fuel economy to an excessive and unreasonable degree...”⁸ If these standards are revised, EPA must submit an “analysis of the cost-effectiveness of other strategies for attaining and maintaining national ambient air quality standards...in relation to the cost-effectiveness for such purposes of standards which, but for such revision, would apply.”⁹ This language permits the consideration of cost-effectiveness and economic feasibility when setting these standards.

EPA is authorized to develop aircraft emission standards for any pollutant that “may reasonably be anticipated to endanger the public health or welfare.”¹⁰ In developing these standards, EPA must give “appropriate consideration to the cost of compliance.”¹¹

For another type of regulation, the CAA specifically calls for benefit-cost analysis. When controlling or prohibiting motor vehicle fuels or fuel additives for the purpose of preventing significant impairment of emission controls, EPA must consider “available scientific and economic data, including a cost-benefit analysis comparing emission control devices or systems which are or will be in general use and require the proposed control or prohibition with...[those that]...do not...”¹²

Clean Water Act

Under the Clean Water Act (CWA), EPA’s principal rulemaking activity is to establish effluent limitation guidelines for industrial and municipal waste-water treatment facilities.¹³ The CWA specifies that these guidelines are to be technology based. Non-water quality environmental impacts are to be considered when setting these guidelines, but the benefits of water-quality improvements are not mentioned as factors to be considered.¹⁴ The CWA does provide, however, that more stringent water-quality-based effluent limitations are to be imposed for individual facilities when necessary to meet state water-quality standards.¹⁵

For private treatment plants, the CWA calls for EPA to establish a number of technology-based effluent-limitation guidelines. Best Practicable Technology (BPT) guidelines, for example, are to be established considering “the total cost of application of technology in relation to the effluent reduction benefits to be achieved,” as well as “the age of equipment and facilities involved, the process employed, the engineering aspects of the application of various types of control techniques, process changes, non-water quality environmental impact (including energy requirements), and such other factors as the Administrator deems appropriate.”¹⁶ For these BPT guidelines, the CWA clearly calls for cost-effectiveness analysis and for the consideration of economic feasibility, but limits the consideration of benefits to effluent reduction benefits and non-water quality environmental impacts. The statutory language for the other technology-based effluent-limitation guidelines is similar, but not identical, to the language for BPT. When setting these regulations, EPA only considers the benefit-cost analysis called for in the RIA to the extent authorized for each type of guideline.

The standards for publicly owned treatment works are based upon information relating to “the degree of effluent reduction available through the application of secondary treatment.”¹⁷ Again, these are technology-based standards. Because EPA’s standards predate Executive Order 12291, the issue of whether benefit-cost analysis can be considered in the rulemaking process has not been decided.

Safe Drinking Water Act

Under the Safe Drinking Water Act,¹⁸ EPA must establish national primary drinking water regulations for each contaminant which “may have an adverse effect on the health of persons...”¹⁹

The primary drinking water regulations for each contaminant are to be based on a maximum contaminant level goal (MCLG), set “at a level at which...no known or anticipated adverse effects on the health of persons occur and which allows an adequate margin of safety.”²⁰ The MCLG is based upon these health effects. The primary drinking water regulations are to specify a maximum contaminant level (MCL), set as close to the MCLG as is feasible. The term “feasible” is defined in the Act as meaning “feasible with the use of the best technology, treatment techniques, and other means, which...are available (taking cost into consideration).”²¹ When establishing MCLs, EPA considers health benefits, particularly residual risk at alternative MCL levels as well as costs and technical feasibility.

Toxic Substances Control Act

The Toxic Substances Control Act (TSCA)²² authorizes EPA to prohibit, restrict, or regulate the manufacture, processing, distribution in commerce, use or disposal of any substance that presents “an unreasonable risk of injury to health or the environment.”²³ EPA’s rules are to be applied “to the extent necessary to protect adequately against such risk using the least burdensome requirements...”²⁴

In promulgating any rule under TSCA, EPA is to consider and publish a statement with respect to –

- (A) “the effects...on health and the magnitude of the exposure of human beings...,”
- (B) “the effects...on the environment and the magnitude of the exposure of the environment...,”
- (C) “the benefits of such substance or mixture for various uses and the availability of substitutes for such uses,
and
- (D) “the reasonably ascertainable economic consequences of the rule, after consideration of the effects on the national economy, small business, technological innovation, the environment, and public health.”²⁵

Because this language in TSCA calls for consideration of health and...environmental effects as well as economic consequences, EPA considers all aspects of benefit-cost analysis in establishing rules under this authority.

Resource Conservation and Recovery Act

The Solid Waste Disposal Act²⁶ includes as amendments the Resource Conservation and Recovery Act (RCRA) and the Hazardous and Solid Waste Amendments of 1984. In this paper they are referred to collectively as RCRA, the most commonly used acronym. RCRA directs EPA to promulgate regulations for generators and transporters of solid waste, as well as owners and operators of solid waste treatment, storage, and disposal facilities. Most of these regulations are to “establish such standards...as may be necessary to protect human health and the environment.”²⁷

RCRA clearly places the emphasis in rulemaking upon protecting human health and the environment. Because the act is generally silent with respect to costs, EPA looked at the legislative history to determine Congress' intent. Interpreting this history can be difficult and is often the subject of debate. When issuing the initial RCRA Subtitle C regulations, for example, EPA concluded that it could not consider the cost burden on industry as a basis for lessening the standards, but it could consider cost-effectiveness in choosing among alternatives that would meet the standards chosen.²⁸

Comprehensive Environmental Response, Compensation and Liability Act

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA),²⁹ as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), governs EPA's responses to releases of hazardous substances into the environment, along with EPA's cleanup of inactive hazardous waste disposal sites. EPA must designate which substances are to be considered hazardous and must set the minimum quantities for reporting releases. These are to be based upon whether such releases "may present substantial danger to the public health or welfare or the environment."³⁰ In establishing reportable quantities, therefore, EPA may consider most benefits, but the act is silent with regard to costs or economic impact analysis.

Under CERCLA, EPA is also responsible for revising the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) for the removal of oil and hazardous substances, originally published under the Clean Water Act. This plan is to include "means of ensuring that remedial action measures are cost-effective over the period of potential exposure to the hazardous substances or contaminated materials."³¹ EPA has interpreted this language to mean that it should not consider costs when determining the level of control necessary to protect public health, but can consider cost-effectiveness when choosing among alternatives that would meet the required level of control.

Federal Insecticide, Fungicide and Rodenticide Act

The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) is primarily a licensing statute.³² Most of EPA's actions under FIFRA have to do with registering, and then modifying or canceling the registration of pesticides.

When registering a pesticide, EPA is to determine that the pesticide will not have "unreasonable adverse effects on the environment."³³ These adverse effects are defined to mean "any unreasonable risk to man or the environment, taking into account the economic, social, and environmental costs and benefits of the use of any pesticide."³⁴ If EPA finds that a pesticide already registered has unreasonable adverse effects on the environment, it may cancel the registration or change the classification. In so doing EPA must take into account "the impact of the action...on production and prices of agricultural commodities, retail food prices, and otherwise on the agricultural economy."³⁵

Because the actions taken under this licensing authority are not considered rulemaking under the terms of Executive Order 12291, RIAs are not prepared for these decisions. Because of FIFRA's specific language, a risk-benefit analysis is performed, however, and costs are considered.

EPA's formal rulemaking under FIFRA consists almost exclusively in establishing the data requirements and procedures to be used in the registration process. In establishing these regulations, EPA is to take into account "the difference in concept and usage between various classes of pesticides and differences in environmental risk and the appropriate data for valuating such risk between agricultural and non-agricultural pesticides."³⁶ It must also consider "the effect of the regulation on production and prices of agricultural commodities, retail food prices, and otherwise on the agricultural economy..."³⁷ This language covers most of the costs and benefits associated with pesticide use. Thus, it authorizes EPA to consider most of the benefit-cost and economic impact analyses in the RIA when establishing regulations under FIFRA.

Atomic Energy Act

Under the Atomic Energy Act and its amendment, the Uranium Mill Tailings Radiation Control Act (UMTRCA), EPA may establish regulations for managing and disposing of radioactive wastes. A recent amendment to UMTRCA requires EPA to "consider the risk to the public health, safety, and the environment, the environmental and economic costs of applying such standards and such other factors as the Administrator determines to be appropriate."³⁸ This broad language allows EPA to consider all aspects of benefit-cost analysis in setting standards under UMTRCA.

Chapter 4

EPA's Benefit-cost Analyses: 1981-1986

Executive Order 12291 requires EPA to prepare RIAs only for major rules. As the following table shows, less than 2 percent of the approximately 1,000 regulations issued by EPA from 1981 through 1985 were considered major.

Table 4-1

**Number of Major and Non-major Regulations
Issued by EPA: 1981- 85***

Year	Non-Major		Major	
	Proposed	Final	Proposed	Final
1981	270	462	1	1
1982	152	182	1	5
1983	154	112	1	1
1984	166	129	7	0
1985	<u>168</u>	<u>122</u>	<u>5</u>	<u>7</u>
TOTAL	910	1,007	15	14

Source: Office of Management and Budget.

*Most, but not all, regulations are counted twice, as both proposed and final.

From February 1981 through February 1986, the period covered by this report, EPA issued 18 major rules as proposed and/or final rules (see Table 4-2). It prepared RIAs for 15 of these major rules. OMB exempted the other three major rules from the RIA requirements.

During this same five-year period EPA analyzed many non-major rules. While the executive order does not require such analysis, OMB'S guidelines require EPA to perform sufficient analysis to demonstrate that non-major rules meet the order's objectives. At a minimum, this analysis must examine costs and economic impacts.

Table 4-2

EPA's Major Rules
February 1981- February 1986

Act/Rule	Proposed	Final	RIA	Exemption
Clean Air Act				
National Ambient Air Quality Standards for Nitrogen Dioxide	1984	1985	Yes	
National Ambient Air Quality Standards for Particulate Matter	1984		Yes	
Requirements for Implementation Plans: Surface Coal Mines and Fugitive Emissions	1984		Yes	Published RIA 2/86
Control of Air Pollution from New Motor Vehicles and New Motor Vehicle Engines; Gaseous Emission & Particulate Emission Regs.	1984	1985	Yes	
Stack Height Regulation	1984	1985	No	Court Deadline
National Ambient Air Quality Standards for Carbon Monoxide	1980	1985	Yes	
Fuels and Fuel Additives: Gasoline Lead Content Regulations	1985	1985	Yes	
Clean Water Act				
Iron and Steel Manufacturing Point Source Category: Effluent Limitations Guidelines		1982	Yes	
Organic Chemicals and Plastics and Synthetic Fibers Industry Effluent Guidelines	1983		Yes	
Toxic Substances Control Act				
Asbestos: Proposed Mining and Import Restrictions and Proposed Manufacturing, Importation, and Processing Prohibition	1985	1986	Yes	
PCB Manufacture Processing, Distribution in Commerce, and Use Prohibitions in Electrical Transformers	1984	1985	Yes	
Premanufacture Notification: Premanufacture Notice Requirements and Review Procedures	1980	1983	Yes	
Resource Conservation and Recovery Act				
Standards for Owners and Operators of Hazardous Waste Land Disposal Facilities	1981	1982	No	Court Deadline
Codification Rules	1985	1985	No	Legislated Deadlines
Management of Used Oil	1985		Yes	
Restrictions on Land Disposal of Hazardous Wastes	1986		Yes	
Comprehensive Environmental Response, Compensation & Liability Act				
National Oil and Hazardous Substances Contingency Plan		1982	Yes	
Federal Insecticide, Fungicide and Rodenticide Act				
Data Requirements for Pesticides Registration	1982/84	1984	Yes	

Although this paper focuses on the benefit-cost analyses prepared as part of the RIAs for the major rules, many of the benefit-cost analyses prepared for the non-major rules represent significant analytic efforts. For this reason, they are included to some extent in the discussion. However, only the RIAs for the major rules are included in the tables and charts.

Contents of the RIAs

The appendix summarizes each of the RIAs prepared by EPA for major rules, presents their conclusions, and comments on how extensively EPA used them in its rulemaking. Table A-1 in the appendix lists the RIAs prepared for the major rules.

Table 4-3 summarizes how each of the RIAs prepared by EPA for major rules meets the requirements of Executive Order 12291 as regards benefit-cost analysis. How each of the RIAs meets the more detailed specifications of EPA's and OMB's guidelines is summarized in Table A-2 in the appendix.

The benefit-cost analyses prepared for air and water regulations were more complete than those for the other program areas. This is because the data and analytic techniques necessary for the analysis of pollutant quantities, exposures, and adverse effects are available more often for air and water regulations than for some of the other regulations. The eight analyses for air and water plus two others were able to estimate the impact of alternatives upon ambient pollution concentrations. Twelve benefit-cost analyses estimated changes in exposure and/or reductions in adverse effects projected as a result of the regulatory action. Six of these analyses traced the benefit estimates completely from improved ambient conditions through reduced exposures and reduced adverse effects through to estimates of the monetized value of benefits. Because benefits were monetized in only these analyses, only six of the benefit-cost analyses estimated net benefits.

These six analyses provided EPA with direct comparisons of the benefits and costs of regulatory alternatives. Two of these analyses (lead in fuels and NAAQS-PM) showed that more stringent standards could lead to greater benefits for society. One analysis (surface coal mines) showed that costs would exceed benefits for two of the three alternatives proposed. Another (organic chemicals) revealed hitherto unanalyzed inter-media pollution effects that EPA is now taking into consideration. The remaining two analyses (iron and steel and PCBs) confirmed the positive net benefits of the preferred regulatory alternatives.

The RIAs that did not monetize net benefits typically evaluated regulatory alternatives on the basis of cost per life saved; cost per ton of pollutant removed, or a similar cost-effectiveness measure. Although these studies might be more appropriately termed cost-effectiveness studies, they are included in this report under the more general heading of benefit-cost studies because they compare quantified benefits with monetized costs.

Although these analyses did not provide EPA with directly comparable estimates of benefits and costs, they were useful in showing the relationships between benefits, however measured, and costs. Two of these analyses (used oil and national contingency plan) assisted EPA in

Table 4-3
EPA's Benefit-cost Analyses: 1981-86

Act/Rule	Benefits	Costs	Net Benefits
Clean Air Act			
NAAQS - N02	X	\$	
NAAQS - PM	\$	\$	\$
Surface Coal Mines	\$	\$	\$
Heavy Duty Motor Vehicles	X	\$	
NAAQS - CO	X	\$	
Lead in Fuels	\$	\$	\$
Clean Water Act			
Iron and Steel	\$	\$	\$
Organic Chemicals	\$	\$	\$
TSCA			
Asbestos	X	\$	
PCBs	\$	\$	\$
Premanufacture Review	X	\$	X
RCRA			
Used Oil	X	\$	
Land Disposal	X	\$	
CERCLA			
Contingency Plan	X	\$	
FIFRA			
Data Requirements	X	\$	X

X = Item discussed.

\$ = Item discussed and monetized.

selecting regulatory alternatives that will result in greater environmental benefits at less cost. Another (TSCA premanufacture review) showed how the costs of the regulation could be reduced considerably with no significant reduction in benefits. A fourth analysis (small quantity generators), on the other hand, showed that greater benefits could be achieved with only a small increase in costs.

Influence of the Benefit-cost Analyses

Whether benefit-cost analyses have an important influence on a regulation's development depends on the degree to which benefit-cost considerations provide clear-cut distinctions between alternatives, and also on the legislative authority under which EPA issues the regulation. When trade-offs between benefits and costs have been central issues in choosing among regulatory alternatives, and when the legislative authority has allowed the full consideration of benefits and costs, the benefit-cost analyses have played an important role in the decision-making process.

The following paragraphs discuss how each of the benefit-cost analyses for major rules and some of those for non-major rules have influenced the rulemaking process at EPA. This information has been assembled from the RIAs themselves and from discussions with EPA officials involved in preparing the RIAs and in making regulatory decisions.

Clean Air Act

NAAQS

Under the Clean Air Act, the primary NAAQS have been based solely on human health effects, without consideration of welfare benefits, costs, or economic impacts. The cost analyses in the benefit-cost analyses for the primary NAAQS for nitrogen oxides, particulate matter, and carbon monoxide were not used in the rulemaking decisions.

Even though the benefit-cost analyses played no role in EPA's decision making, they were not without value. For example, the analysis for the PM-NAAQS helped explain to the public the effects of EPA's decision, and showed that more stringent standards could lead to greater benefits to society.

Surface Coal Mines

In analyzing the listing of surface coal mines for new-source review, EPA considered the benefits and costs of three alternatives relative to current standards. The analysis showed that the costs of two of the alternatives exceeded the benefits. The results of the benefit-cost analysis for the third alternative were inconclusive. EPA is reviewing public comments to the proposal.

Heavy Duty Motor Vehicles

In setting or revising certain emission standards for heavy duty motor vehicles under the Clean Air Act, EPA must achieve the greatest degree of emission reduction available, but must also give appropriate consideration to costs. The RIA for the heavy duty motor vehicle standards examined the cost-effectiveness of several alternatives. The alternatives chosen were selected on

the basis of the degree of pollution reduction, health and welfare impacts, and technical feasibility, supported by the cost-effectiveness determinations.

Lead In Fuels

Benefit-cost analysis played an important role in this regulation. In 1982 EPA had tightened its standard for lead in gasoline, and there was no legislative or other pressure on EPA to further revise the standard. After reviewing new information, however, EPA officials realized in 1984 that the benefits of a further reduction in lead content might be substantial. Accordingly, EPA fully analyzed the benefits and costs of the alternatives.

This analysis revealed that reducing the lead content in gasoline from 1.1 to 0.1 grams per gallon would reduce adverse health effects and medical care and educational costs for children with high blood lead levels; could reduce deaths, illnesses, and lost wages from cardiovascular and other diseases; would reduce emissions of other pollutants; and would improve fuel economy and reduce motor vehicle maintenance costs. The present value of the net benefits to the nation from 1985 through 1992 of lowering the lead standard to 0.1 grams was calculated to be \$6.7 billion, without considering the benefits of anticipated reductions in adult blood pressure, the value of which is yet to be determined.¹ In large part because the benefit-cost analysis showed such dramatic net benefits, EPA revised its lead in gasoline standard in 1985 to 0.1 grams per gallon, which became effective on January 1, 1986. Although EPA might have adopted this revision even without the benefit-cost analysis, that analysis, and the increase in net benefits it showed, provided a strong justification for the revision.

Clean Water Act

Under the Clean Water Act, EPA considers the economic feasibility of its effluent guidelines, but does not consider site-specific benefits of water quality improvements. For the effluent guidelines for the iron and steel industry, the analysis performed as part of the RIA confirmed the positive net benefits of the decision that was made using the criteria specified in the Act.

In preparing the benefit-cost analysis for the proposed organic chemicals guidelines, EPA found that wastewater treatment processes, which removed pollutants from waste streams before they reached receiving water bodies, could generate significant emissions of volatile organic compounds (VOCs) into the air. This analysis showed that the treatment options originally considered might not be sufficient to control the transfer of pollution from the water to the air. Consequently, in a July 1985 Federal Register notice, EPA announced its intention to consider new options to control air emissions of VOCs. Thus, in highlighting the intermedia transfer issue, this benefit-cost analysis led to the introduction of the new regulatory options that are now being considered as part of this rulemaking.

Safe Drinking Water Act

Under the Safe Drinking Water Act, EPA considers both health risks and economic feasibility in deciding upon drinking-water standards. Although EPA has promulgated no major rules under the Safe Drinking Water Act since Executive Order 12291 was issued, in the

course of preparing regulatory analyses for its standards pertaining to fluoride and VOCs in drinking water EPA considered benefits and costs. The analysis for the proposed VOC MCLs showed substantial differences in the cost-effectiveness of alternative standards. This information is being considered as part of the regulatory decision making.

Toxic Substances Control Act

Asbestos

EPA announced regulations for asbestos before the issuance of Executive Order 12291. After this order, the benefit-cost analysis already under way became part of an extensive RIA. The analysis included ten options in addition to the proposed option. The results of this analysis supported the proposal to ban some uses of asbestos and to phase out others.

PCBs

EPA prepared three different benefit-cost analyses in conjunction with the regulation of PCBs, although only one of these was associated with a major rule. For uncontrolled sources, industry and environmental groups negotiated a proposed rule. The benefit-cost analysis was used mainly to verify the economic feasibility of that proposal. For the regulation of PCBs in transformers, the benefit-cost analysis was used to determine the economic feasibility of the various options. This proved useful in selecting the alternatives preferred for the different segments of the regulated community. For the regulation of PCBs in electrical equipment, the RIA played a similarly useful role in determining which options would be feasible for different segments of the industry.

TSCA Premanufacture Review

In establishing the requirements for premanufacture review under TSCA, EPA identified the major issue as being how much information to require on the application form. One major consideration was the limit of EPA's authority – i.e., how much information EPA could legally require. Costs and economic impacts were another major consideration in this rulemaking, because there was concern that high costs might discourage innovation in the chemical industry.

In analyzing the benefits and costs of alternative forms for use in EPA's premanufacture review of new chemicals, EPA's Office of Toxic Substances (OTS) developed a new alternative that would substantially reduce costs without significantly lowering the probability of identifying a problem chemical. The alternative eventually chosen as a result of both the cost and legal considerations provided sufficient information to protect public health, yet cost less than half as much as the alternative originally considered. The total annual savings were estimated to be approximately \$4 million.²

Resource Conservation and Recovery Act

Used Oil

RCRA directed EPA to consider the impact upon recycling used oil, when setting standards for managing used oil. The benefit-cost analysis showed that modifying the regulations not only

would reduce costs, but would lead to an increase in recycling and a concomitant decrease in risk.

Before the benefit-cost analysis, EPA had considered applying the full RCRA hazardous waste regulations uniformly to all categories of generators of used oil. The benefit-cost analysis showed that the cost of the full regulations would be large for small generators, and that this could lead to the increased dumping of used oil. By proposing different standards for small, medium, and large generators, and by reducing standards for some used oil transporters, EPA reduced the estimated cost of the proposed regulation by approximately \$358 million a year.³ In addition, reducing the costs to small generators would lead to fewer incidents of dumping, which would in turn result in fewer cases of cancer.⁴

Land Disposal

RCRA calls for the prohibition of the land disposal of hazardous wastes, unless the waste is pretreated in accordance with standards set by EPA, or unless the Administrator determines that a method of land disposal would prevent migration of hazardous constituents from disposal sites for as long as the waste remained hazardous. Benefit-cost analysis did not play a role in this decision.

Small Quantity Generators

In regulating generators of small quantities of waste, EPA was restricted by RCRA to considering the health effects and the regulatory burden of the regulations. The proposed rule required minimal paperwork from small-quantity generators. Many of the comments received made EPA aware that this aspect of the rule might not provide sufficient information to enforcement personnel. Thus, EPA expanded the benefit-cost analysis to address this issue.

The revised analysis showed that the cost of additional record-keeping requirements for each facility would be only \$34 per year, which would not increase the burden to the regulated community significantly.⁵ Thus, the benefit-cost analysis helped resolve the issue and led to setting a stricter standard than was originally proposed.

Comprehensive Environmental Response, Compensation and Liability Act

In developing the 1982 revisions to the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), EPA considered costs as well as engineering feasibility, environmental, welfare and public health effectiveness in choosing among alternative regulatory options, but did not consider monetized benefits. The RIA showed the proposed alternative, which emphasized public health concerns in characterizing the objectives of the NCP revisions, to be less costly and to result in a greater reduction in the population exposed to contaminated groundwater than the other alternative considered, which emphasized public welfare and the

* In November 1986, subsequent to the time period covered by this report, EPA announced that it would not list any used oil bound for recycling as hazardous waste and would reconsider its proposed regulation for used oil bound for disposal.

environment. EPA's subsequent revision to the NCP in 1985 was not considered a major rule and consequently was not accompanied by an RIA.

Federal Insecticide, Fungicide and Rodenticide Act

Of the regulations promulgated by EPA under FIFRA, the one for which benefit-cost analysis had the most impact was the establishment of data requirements for registering pesticides. Early in the regulatory process, the analysis of benefits and costs showed that testing all new pesticide formulations would be extremely expensive, compared with testing only active ingredients, and would not have any substantial benefits. Consequently, this alternative, which was not cost-effective, was eliminated very early in the decision-making process.

The benefit-cost analysis for the emergency exemption regulations, a non-major rule under FIFRA, played a similar role to that for data requirements. Throughout the rulemaking process, the costs and benefits of suggested alternatives were analyzed. These analyses eliminated most suggestions and eventually pointed to the cost-effective alternatives that were finally considered in the rulemaking.

Chapter 5

Contributions of Benefit-cost Analysis

As we have seen, the benefit-cost analyses prepared by EPA have clearly influenced the regulations for which they were written. But the contributions of these analyses go beyond individual regulations. They have increased awareness of the environmental results of EPA's regulations, provided a framework for comparing regulations both within a single medium and across media, identified cross-media effects, and improved analytic techniques.

Improving Regulations

Chapter 4 provides examples of the different ways that benefit-cost analysis has improved individual environmental regulations. These include:

1. guiding the regulation's development (lead in fuels);
2. adding new alternatives (TSCA premanufacture review, organic chemicals, small-quantity generators);
3. eliminating alternatives that are not cost-effective (FIFRA data requirements);
4. adjusting alternatives to account for differences between industries or industry segments (asbestos, PCBS, used oil); and
5. supporting decisions (heavy duty motor vehicles, iron and steel).

In some cases benefit-cost analyses have improved regulations by showing how more stringent alternatives would bring about a greater reduction in pollution without an undue increase in costs. In two instances this led to the adoption of regulations that were more stringent than previously contemplated (lead in fuels and small-quantity generators). In other cases the analyses showed that the costs of more stringent regulations would be disproportional to the expected benefits. In three instances this led EPA to select less stringent regulatory alternatives (FIFRA data requirements, TSCA premanufacture review, and used oil). In each of these cases, the result has been reduced regulatory burdens without significant reductions in environmental improvement.

The monetary value of three of these regulatory improvements, as measured by the potential increase in net benefits attributable to the regulations, is summarized below.

Potential Increase in Net Benefits of Regulations

RIA	Change in Regulation	Potential Increase in Total Net Benefits
Lead in Fuels	more stringent standard, greater health and welfare benefits	\$6.7 billion ¹
Used Oil	reduced regulatory costs, greater reduction in risk	\$3.6 billion ²
Premanufacture Review	reduced regulatory costs, no significant reduction in effectiveness	\$40 million ³

While these potential improvements cannot be attributed solely to benefit-cost analyses, it is fair to say that these analyses played a major role in bringing about regulatory improvement.

Compared to these regulatory improvements of over \$10 billion, the cost of performing the analyses has been modest. Twelve of the fifteen RIAs prepared by EPA for major rules cost less than \$10 million (see Chapter 6). Thus, the return to society from improved environmental regulations is more than one thousand times EPA's investment in the benefit-cost analyses.

Increasing Awareness of Environmental Results

EPA's first regulatory analyses focused upon costs and economic impacts. As the marginal benefit of increased regulation became more of an issue, and as analytic techniques improved, EPA undertook more benefit-cost analyses. Executive Order 12291 brought this trend to its logical conclusion by requiring benefit-cost analysis of most major rules and by designating net benefits as the measure of a regulation's merit.

The formal consideration of benefits for each proposal has brought to light considerably more information about the environmental results of EPA's regulations than has been available before. This has led to an increased awareness of the improvements in human health and welfare and the environment that result from environmental regulation.

The benefit-cost analysis for lead in fuels discussed in Chapter 4 provides a good example of this effect. In analyzing the benefits of reducing the lead content of gasoline, EPA learned a great deal about the health benefits that would result if lead emissions were reduced. This resulted in a substantial reduction in the lead content permitted in gasoline. EPA is also using some of the information from this benefit-cost analysis to evaluate the benefits of reducing lead in drinking water. This is a good example of how benefit-cost analysis can contribute to an increased environmental awareness that goes beyond a specific regulation.

Creating a Consistent Framework for Evaluating Environmental Initiatives

The benefit-cost approach means that regulatory proposals now integrate scientific and economic information into a more consistent, comprehensive framework that informs decision makers about the expected outcomes of alternative regulatory proposals. Estimating and monetizing both the benefits and costs of regulations result in a set of measures that can be used not only to evaluate the alternatives for each regulation, but also to compare different regulations and environmental programs across media. This makes it possible to begin to examine the relative effectiveness of different regulations and different programs.

Highlighting Cross-media Effects

Because environmental regulations typically deal with only one medium (e.g., water), their analysis formerly was restricted to one medium. Benefit-cost analyses cover all media. In some cases, this has led to an awareness of cross-media effects that had not been noted previously.

For example, in analyzing the benefits of treating wastewaters in the plastics and organic chemicals industries, EPA learned that the systems being considered to treat water pollution would volatilize many organic compounds, thereby creating a potential air pollution problem near the treatment sites. As a result, EPA is considering additional regulatory approaches.

The increased awareness of cross-media effects has led to similar studies in many program areas. EPA's budget priorities for FY 1987 include cross-media reviews for municipal combustors and wastewater sludge management. In addition, EPA's Office of Policy, Planning and Evaluation has initiated a series of integrated environmental management studies that are examining intermedia risk transfers associated with all types of pollution control activities in different geographic areas.

Improving Analytic Techniques

The increased emphasis on benefits has stimulated the introduction of new measures of environmental results and has led to improvements in existing techniques for estimating benefits. Similarly, the formal requirements for full cost and economic impact analyses have stimulated improvements in the techniques used to estimate costs and economic impacts.

The analysis prepared for the National Ambient Air Quality Standard for Particulate Matter illustrates the progress that has been made in quantifying benefits. Because of recent scientific and economic developments and the availability of new data, EPA was able to break new ground for this analysis. The analysis used several techniques for estimating indicators of environmental benefits, including exposure-response estimates, hedonic models of changes in property values or wages, and direct economic models of behavioral responses of individuals and firms. Using these different measures, EPA estimated the net benefits of each regulatory alternative. The resulting range of net benefits for each alternative could then be compared and evaluated, taking the pros and cons of each technique into account.

Chapter 6

Limitations of Benefit-cost Analysis

Benefit-cost analysis and the RIA process have been subject to considerable scrutiny since Executive Order 12291 was issued. The GAO report¹ pointed to a number of limitations in the three analyses it reviewed, and a number of subsequent studies² have addressed the subject. In addition, EPA's Office of Policy, Planning and Evaluation recently published a report on how to improve RIAs for hazardous waste regulations ("EPA's study").³

In general, three major types of limitations are discussed in these reviews: (1) those inherent in the nature of economic analyses in general, (2) those caused by gaps in available information and deficiencies in analytic techniques, and (3) those that are the result of errors and omissions in the execution of the analysis. Another issue that has been raised is the cost and time required to perform benefit-cost analyses.

Limitations of Economic Analysis

Benefit-cost analysis, in particular the estimate of net benefits, provides only one perspective on regulatory alternatives. A single measure of efficiency, such as net benefits, can never present a complete picture of issues that deal with such complex matters as risks to human health and environmental degradation. An estimate of net benefits cannot account for differences in technical feasibility among alternatives, for example, even though feasibility questions may be of paramount importance.

The results of benefit-cost analyses must always be regarded in light of the results of other types of analyses, the uncertainties inherent in complex environmental situations, and the many subjective evaluations that must accompany environmental decisions. Some of the limitations of the economic measures used in benefit-cost analyses are discussed below.

Efficiency Measures

Every economic measure of efficiency is based upon a number of implicit assumptions. A simple estimate of net benefits, for example, assumes that distributional effects are not important. Yet distributional effects are almost always significant in environmental decisions. Usually, environmental regulations increase costs for one group of people – the polluters – and produce benefits for another group – the public in general, and especially the people who live near the polluters. On the one hand, these results may be viewed as transfers of wealth from the polluters to the public. On the other hand, they may be viewed as restoring to the public the benefits of a clean environment that had been taken from them.

Another assumption implied in using maximum net benefits as a decision rule is that this is the sole objective of environmental decision making. Again, this is oversimplification, for

environmental decisions often are based on many objectives. Decision makers may want to provide incentives for further research and development, for example, or may want to minimize unemployment and economic dislocations.

EPA's RIA guidelines call for a full discussion of all distributional effects, feasibility considerations, and other issues that may be important to the environmental decision. Nevertheless, because benefit-cost analysis tends to focus on numerical estimates of net benefits, there is always the danger that these other issues will be given insufficient attention.

Single Estimates

Many benefit-cost analyses express net benefits in terms of a single dollar value, rather than as a range of dollar values. These point estimates may hide many uncertainties in the underlying analyses. As explained in more detail below, there are often many gaps in the data that must be used in benefit-cost analyses, and there may be deficiencies in the analytic techniques as well.

EPA's RIA guidelines specify that estimates of net benefits should be presented as a range of estimates and should be accompanied by a full discussion of the uncertainties involved. Nevertheless, the GAO study found that this directive was often ignored. One of GAO's strongest recommendations was that EPA place more emphasis on the uncertainties inherent in the benefit-cost analyses and that estimates be presented as ranges, rather than point estimates.

Valuation of Human Health

Perhaps the most controversial issue in relation to the economic analysis of environmental regulations is the valuation placed upon reducing health risks. EPA's guidelines offer extensive information on current techniques that are available for making such estimates, but the state of the art in this area remains controversial. There is no consensus on the value of reducing morbidity and mortality risks. Nevertheless, it is necessary to develop a general understanding of these issues, so that comparisons can be made among the multitude of human health and welfare benefits that result from environmental regulations.

The most common approaches used by economists to derive a value for reducing risks to human life are based upon laborers' willingness to accept increased risk in exchange for additional wages. While these studies provide some insight into how people view increased risks to life and limb, not everyone will agree that the methodology is sound. Some commenters argue that workers are not well informed and may not make employment decisions freely, without economic pressure. Others point out that workers may not perceive their increased risks as significant and would act much differently, if they thought that they actually would lose their lives.

There is no unequivocally valid method for converting human health risks into monetary terms. As the National Academy of Sciences' Committee on Principles of Decision Making for Regulating Chemicals in the Environment concluded:

Different individuals place different values on things such as human life, aesthetics, or national security. Thus an analysis that assigns a quantitative value to...these factors is necessarily subjective, and to some degree, arbitrary.⁴

Discounting Future Benefits

Another controversial issue in relation to the economic measures used in RIAs is the question of evaluating future benefits. Not only is there the problem of estimating the value of benefits that may only potentially be realized, i.e., groundwater that is not now but may become a source of drinking water, but there is also the problem of placing a dollar value on benefits realized in the future when compared with benefits realized today.

OMB's guidelines Call for all benefits and costs to be discounted back to the present, using a discount rate of 10 percent, although the effect of using other discount rates may also be analyzed. Some commenters argue that a real rate of 10 percent is too high, and a more appropriate rate would be in the range of 5 to 7 percent. Others argue that it is inappropriate to use the discount rate for money when discounting human health risks. Yet others argue that there is no legitimate discount rate that can be applied to future "lives saved," because there are no real-world market transactions in "life saving" that can be used to assess the value that society places on future lives saved versus current lives saved.

While some economists are proponents of discounting, others argue that reductions in future health risks should never be discounted, because discounting may significantly reduce the apparent severity of future health effects, and lead to the choice of an inequitable option. When using a 10 percent discount rate, for example, we value 100 lives saved 30 years in the future the same as 6 lives saved in the present. Thus, when a high discount rate is used, expenditures made to save lives in the future appear to be much less effective than expenditures that will save lives today.

Discounting is designed to help assess only whether an action is efficient, not whether it is equitable. As shown above, discounting for environmental regulations that span several generations may obscure intergenerational inequities. Thus, discounting again raises the question of how efficiency measures, such as net benefits, can account for distributional inequities, such as the distribution of health risks among generations.

Information Gaps and Analytic Deficiencies

Benefit-cost analyses can involve the collection of vast amounts of scientific data, the modeling of complex environmental phenomena, and the tracing of these environmental phenomena through to the calculation of human exposures and the estimation of resultant diseases and deaths. Estimating costs and economic impacts can involve similar degrees of difficulty. Not surprisingly, there are many gaps in the scientific knowledge and many deficiencies in the analytic techniques necessary to complete these analyses.

The GAO report identified several such gaps in the three analyses studied.⁵ These included difficulties in determining the changes in air and water quality that result from reductions in discharges, problems in relating changes in air and water quality to diseases, the necessity of having to estimate health risks to humans from low-level doses of pollution using data from experiments that were based on high-level doses to animals, and problems associated with having to use health studies from the United Kingdom, where the chemical makeup of the air

might differ significantly from that in the United States. These last two deficiencies highlight a related problem: even though scientific data may be available, they may not be available in a form that is directly applicable to the proposed regulations.

A good example of this is provided by the recent proposed National Ambient Air Quality Standard for particulate matter. EPA proposed to express the standard in units of particulate that are 10 microns or less in diameter (PM10), because it believed that these smaller particulates are better indicators of the particles that are or concern for human health. Unfortunately, much of the research on particulate matter is expressed in units other than PM10, units that may be less useful for estimating health effects.

EPA's study found several limitations in many of the analytic methods used in the benefit-cost analyses. Among other things, the study recommended that EPA (1) develop more realistic models to estimate releases to groundwater, (2) generate more explicit estimates of the fate of toxic chemicals in air, surface water, landfills, and groundwater, (3) develop more realistic exposure models including the actual timing, persons affected, and levels of expected exposure, and (4) develop dynamic models for estimating the impacts of increased costs upon market behavior.

When data are poor or analytic techniques deficient, the reliability of the benefit-cost analyses deteriorates. To protect the soundness of the environmental decisions based on such analyses, decision makers must be informed of the effect that uncertainties have upon the assessment of the regulatory alternatives. Although EPA's RIA guidelines call for a full discussion of all analytic uncertainties in benefit-cost analyses, the GAO report and EPA's study both found that these guidelines were not always followed adequately. The GAO report recommended more discussion of uncertainties and EPA's study recommended that more sensitivity analyses be performed whenever considerable uncertainties in the data or analyses exist.

Deficiencies in Execution

Besides the questions of fundamentals and state of the art is the question of whether benefit-cost analyses are prepared correctly. In light of the many complex analyses required for each regulation, it is not surprising that several of the EPA's benefit-cost analyses have been found to be deficient.

The GAO report found several deficiencies in three benefit-cost analyses. In one case EPA failed to consider costs for new sources in determining whether a rule was to be classified as major. In the same case, EPA did not consider any regulatory alternatives. In other cases, EPA did not evaluate the benefits and costs of some of the most promising alternatives. EPA was also criticized for not considering all categories of benefits and costs in its analyses. Perhaps the most emphasized of the deficiencies identified in the GAO report is that EPA did not prominently discuss the uncertainties of its analyses and did not present decision makers with ranges of values that would reflect those uncertainties.

Several other studies have found deficiencies in the technical aspects of some of EPA's benefit-cost analyses.⁶ These include (1) using unrealistic assumptions when preparing exposure estimates, (2) not assigning dollar values to health benefits (3) not using common time periods when estimating benefits and costs, (4) failing to consider distributional effects, (5) improperly considering employment consequences and (6) not incorporating overall market trends into the economic analyses.

EPA's RIA guidelines provide technical guidance on how to properly prepare benefit-cost analyses. These guidelines deal with all of the deficiencies mentioned above. If these guidelines are followed, EPA's analyses will be as good as the underlying data and analytic techniques permit. But because time, budget, and other considerations do not always support complete analyses, it is important that, at the very least, decision makers be made aware of the deficiencies in each analysis and the implications thereof.

Cost of the Analyses

Benefit-cost analyses require significant time and resources to complete. Some commenters have questioned whether the analyses are worth their cost.

Table 6-1 presents estimates of the costs of the RIAs prepared by EPA. The total cost of the twelve RIAs for which cost information is available was approximately \$8.1 million. The cost of each RIA ranged from \$210,000 to \$2,380,000, with an average cost of approximately \$675,000.⁷

When compared with the costs of at least \$100 million per year that are associated with each major regulation, a one-time cost of less than \$1 million for each benefit-cost analysis seems modest. As explained in Chapter 5, benefit-cost analyses often result in significant regulatory improvements worth many times the costs of the analyses. Three of the benefit-cost analyses covered by this report helped to increase the net benefits associated with their respective regulations by over \$10 billion.

Table 6-1**Estimated Costs of RIAs**

Act/Rule	Contractor Costs	EPA Personnel		Total Costs
		FTE (yrs)	\$	
Clean Air Act				
NAAQS - NO ₂	\$744,000	3.5	\$210,000	\$954,000
NAAQS - PM	\$1,541,000	14.0	\$840,000	\$2,381,000*
Surface Coal Mines	\$150,000	1.0	\$60,000	\$210,000*
Heavy Duty Motor Vehicles	n.a.	n.a.	n.a.	n.a.
NAAQS - CO	\$405,000	2.0	\$120,000	\$525,000
Lead in Fuels	\$522,000	8.0	\$480,000	\$1,002,000
Clean Water Act				
Iron and Steel	\$150,000	2.5	\$150,000	\$300,000
Organic Chemicals	\$225,000	2.0	\$120,000	\$345,000*
TSCA				
Asbestos	\$915,000	2.5	\$150,000	\$1,065,000*
PCBs	\$156,000	1.0	\$60,000	\$216,000*
Premanufacture Review	n.a.	n.a.	n.a.	n.a.
RCRA				
Used Oil	\$450,000	1.5	\$90,000	\$540,000*
Land Disposal	\$200,000	3.0	\$180,000	\$380,000
CERCLA				
Contingency Plan	n.a.	n.a.	n.a.	n.a.
FIFRA				
Data Requirements	\$40,000	3.5	\$210,000	\$250,000

* Rule has been proposed, but is not yet final. Further analysis may be required.

n.a. = not available

Source: See note #7, Chapter 6.

Chapter 7

Directions for the Future

Benefit-cost analysis has proven to be a useful tool not only for comparing alternatives for a specific regulation, but also for comparing the relative value of the many different regulations that are written in response to EPA's various statutory authorities. Through such analyses EPA is increasing its ability to decide how to apply the nation's limited resources to achieve greater levels of environmental protection, not only within but across environmental media.

As EPA has advanced its analytic capability, it has begun to discover limitations in some of the traditional decision criteria for setting standards. EPA's experience shows that these decision criteria, such as "health effects thresholds," margins of safety, and technical feasibility," frequently do not provide clear distinctions for decision making. As is often the case, EPA must then rely upon its analytic capabilities in other areas to provide the information on which to formulate its decisions.

Nowhere is this difficulty more apparent than in setting standards that are to be based on health effects or technology thresholds. For many pollutants it is becoming increasingly difficult to find an established threshold below which there are no adverse health effects. At the same time, engineering advances are producing more pollution control technology that can achieve zero discharge of pollutants, albeit usually at a high cost. Where there are no health effects thresholds and no limits to control technology, then choosing an appropriate level of control may best be done by balancing the relative benefits and costs of additional levels of control. In adopting National Emission Standards for Hazardous Air Pollutants (NESHAPs) for carcinogens, for example, EPA considers both economic and technological feasibility when establishing an ample margin of safety to protect public health.

While recognizing their limitations, EPA finds benefit-cost and similar analyses to be increasingly useful tools in helping provide the balance required when choosing appropriate levels of environmental control. Consequently, EPA is committed to strengthening its capabilities for performing benefit-cost analyses and to improving the research programs that provide the underlying economic, scientific, and technical information for these complex regulatory decisions.

Strengthening Analytic Capabilities

EPA has prepared RIA guidelines to ensure that benefit-cost analyses are based upon the best information available and the best analytic techniques that the state of the art permits. The guidelines provide extensive information on how to perform each portion of the analyses. When written according to these guidelines, the RIAs will not only present thorough benefit-cost analyses, but will also discuss the uncertainties and multidimensional consequences of regulatory alternatives.

EPA is continually refining its RIA guidelines to upgrade the information that is available to assist program offices in preparing benefit-cost analyses. For example, EPA is currently updating its guidance on valuing reductions in mortality and morbidity risks and on alternative procedures for considering future benefits and costs.

EPA's management has implemented an options selection procedure that requires program offices to describe more than one regulatory option and then to document the most likely connection between regulatory expenditures and environmental results. Management is also supporting the establishment of analytical divisions in program offices now lacking analytic personnel and resources. The continued commitment of EPA's management to requiring rigorous analysis from all program offices will ensure that major environmental regulations are properly supported with benefit-cost analyses.

To facilitate better cross-program and cross-media comparisons of risk assessments, EPA is working to ensure that all the data and methodologies used in these assessments are consistent. An example of this effort is the work now under way to develop consistency among the many standards for toxic chemicals. A report by EPA's Chemical Coordination Staff demonstrated that maximum exposure limits (MELs) for many chemicals often were not consistent across programs. This report identified the need to base MELs upon consistent health data and upon consistent analytic methodology. EPA is now developing the information and the methodology that will be used to bring more consistency to regulations involving these chemicals. EPA recently released guidelines for assessing the risks associated with cancer, mutagenicity, chemical mixtures, and developmental toxicity, and for estimating exposures. Additional risk assessment guidelines are being prepared.

Focusing Environmental and Economic Research

Since the late seventies, EPA's research, and development program has become increasingly more focused on providing the data and methods required for sound regulatory development.

The 1978 annual authorization for environmental research carried a very strong message from Congress that the relationship between environmental research and regulation must be strengthened. To that end, EPA established several pilot research planning committees comprised of senior research scientists and EPA regulatory office representatives to jointly set the research agenda for the coming years. Based on the success of these efforts, the research committee planning approach was expanded over the next several years to encompass EPA's entire research and development program. These committees now meet periodically to review

current-year research projects for relevance to regulatory office priorities, and to plan future research to address critical gaps in data needed for regulatory decision making. Benefit-cost analyses provide a framework for identifying those areas in which better information is required and consequently influence the deliberations of each of the research committees.

Two recent developments have served to sharpen the focus of EPA's scientific research on regulatory needs. First, the Assistant Administrator for EPA's Office of Research and Development (ORD) has conducted meetings with each of EPA's program offices to set out their mutual understanding of the highest priority regulatory activities in the upcoming budget that require ORD's support. And second, EPA's Deputy Administrator has established a process by which program offices, on completing a rulemaking that is subject to periodic review, identify in writing to ORD those data gaps that should be filled before the next review cycle. Both of these efforts reflect EPA's greater reliance on high-quality research outputs for informed decision making. Two areas receiving ORD's increased attention are improving estimates of total human exposure to pollutants and relating pollutant exposure more precisely to health and ecological outcomes. These areas are crucial to assessing the risks from environmental pollution and evaluating the benefits of pollution control. Knowledge gained in these areas will improve EPA's ability to analyze these important factors in future RIAs.

EPA's Office of Research and Development has also continued to strengthen the mechanisms it uses to ensure the scientific quality of its research products. Recently, it has augmented its longstanding reliance on peer reviews of all published reports to include the establishment of several standing peer review panels composed of experts from outside EPA. Panel members are selected by EPA's Science Advisory Board (SAB) to review research in progress that is of particular importance to the regulatory offices. These panels transmit their views to the SAB and to EPA's Deputy Administrator.

Since FY 1972, EPA has had an extensive research program to improve the economic data and methodologies available for doing cost-benefit analysis. In 1983 EPA's research efforts in that area were consolidated into the Economic Research Program of EPA's Office of Policy Analysis. Although both the economic methodologies and the data used in preparing cost-benefit analyses are much improved over the early 1970s, much still remains to be done if EPA is to be able to accurately value the economic benefits of its proposed regulations. Improved methods are particularly needed for valuing benefits for which no private markets exist. The Economic Research Program has funded much of the research that resulted in the contingent valuation method for valuing such nonmarket goods, and is working to solve the problems that remain before this valuation method can be routinely applied. One problem of particular importance is the lack of adequate methodology and data for valuing most ecological benefits. These and other methodological and data problems are the subject of continuing research, usually in the form of demonstration projects involving applications to proposed EPA regulations.

Notes

Chapter 1

1. United States General Accounting Office, *Cost-Benefit Analysis Can Be Useful in Assessing Environmental Regulations, Despite Limitations*, Report to the Congress of the United States by the Comptroller General (GAO/RCED-84-62), Washington, D.C., April 6, 1984.
2. *Ibid.*, p. 21.

Chapter 2

1. Shultz, George P., Memorandum to the heads of departments and agencies, Subject: "Agency Regulations, Standards, and Guidelines Pertaining to Environmental Quality, Consumer Protection, and Occupational and Public Health and Safety," Office of Management and Budget, Washington, D.C., October 5, 1971.
2. Ford, Gerald R., "Inflation Impact Statements," Executive Order 11821; White House, November 27, 1974.
3. Ash, Roy L., Circular No. A-107 to the heads of executive departments and establishments, Subject: "Evaluation of the Inflationary Impact of Major Proposals for Legislation and for the Promulgation of Regulations or Rules," Office of Management and Budget, Washington, D.C., January 28, 1975.
4. Alm, Alvin L., Memorandum to the Administrator, Subject: "Proposed EPA Guidelines on Inflation Impact Statements," U.S. Environmental Protection Agency, Washington, D.C., no date stated; Attachment A, p. 4.
5. Ford, Gerald R., "Economic Impact Statements," Executive Order 11949; White House, December 31, 1976.
6. Brands, Paul A., "Change in the Inflation Impact Statement Program," Memorandum to all Assistant Administrators, Regional Administrators, and Office Directors, U.S. Environmental Protection Agency, Washington, D.C., January 26, 1971.
7. Carter, Jimmy, "Improving Government Regulations," Executive Order 12044; White House, March 23, 1978.
8. U.S. Environmental Protection Agency, *Improving Environmental Regulations; Final Report Implementing Executive Order 12044*, Washington, D.C., June 1979.
9. Regulatory Flexibility Act.
10. Reagan, Ronald, "Federal Regulation," Executive Order 12291, White House, February 17, 1981.
11. *Ibid.*, Section 2(c).
12. *Ibid.*, Section 2(b).

13. Ibid., Section 3(d).
14. Office of Management and Budget, “Interim Regulatory Impact Analysis Guidance,” Washington, D.C., June 5, 1981.
15. United States Environmental Protection Agency, *Guidelines for Performing Regulatory Impact Analysis* (EPA-230-01-84-003); Washington, D.C., December 1983.

Chapter 3

1. Clean Air Act (42 U.S.C. 7401 et seq.).
2. Ibid., Section 109(b)(1).
3. Ibid., Section 109(b)(2).
4. Ibid., Section 302(h).
5. Ibid., Section 113(b)(1)(B).
6. Ibid., Section 111(a)(1)(C).
7. Ibid., Section 202(a)(3)(A)(iii).
8. Ibid., Section 202(a)(3)(C)(I).
9. Ibid., Section 202(a)(3)(D)(ii).
10. Ibid., Section 231(a)(2).
11. Ibid., Section 231(b).
12. Ibid., Section 211(c)(2)(B).
13. Clean Water Act As Amended Through February 1982 (33 U.S.C. 466 et seq.).
14. Ibid. See, for example, Section 304(b)(1)(B).
15. Ibid., Sections 303, 301(b)(1)(C).
16. Ibid., Section 304(b)(1)(B).
17. Ibid., Section 304(d)(1).
18. Safe Drinking Water Act Amendments of 1986 (42 U.S.C. 5300f et. seq.).
19. Ibid., Section 101(b)(3)(A).
20. Ibid., Section 101(b)(4).
21. Ibid., Section 101(b)(5).
22. Toxic Substances Control Act; October 11, 1976 (15 U.S.C. 2601 et. seq.).
23. Ibid., Section 6(a).

24. Ibid., Section 6(a).
25. Ibid., Section 6(c)(1).
26. Solid Waste Disposal Act (42 U.S.C. 6901-6991i).
27. Ibid., Section 3002(a).
28. 45 *Federal Register*, May 19, 1980; p. 33089.
29. Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9601 et seq.).
30. Ibid., Section 102(a).
31. Ibid., Section 105(7).
32. Federal Insecticide, Fungicide and Rodenticide Act As Amended; Revised May 1985 (7 U.S.C. 136 et seq.).
33. Ibid., Section 3(c)(5)(C) and Section 3(c)(5)(D).
34. Ibid., Section 2(bb).
35. Ibid., Section 6(b).
36. Ibid., Section 25(a)(1).
37. Ibid., Section 25(a)(2)(B).
38. Public Law 97-415; January 4, 1983; Section 22(b)(2).

Chapter 4

1. U.S. Environmental Protection Agency, Office of Policy Analysis, “Costs and Benefits of Reducing Lead in Gasoline – Final Regulatory Impact Analysis,” EPA-230-05-85-006; Washington, D.C., February 1985, p. VIII-26. Figure is for “Net Benefits Excluding Blood Pressure” from the “No Misfueling” column of Table VIII-8.
2. U.S. Environmental Protection Agency, Economics and Technology Division, “Regulatory Impact Analysis for New Chemical Reporting Alternatives Under Section 5 of TSCA,” prepared by ICF Incorporated, Washington, D.C., May 10, 1983, p. 206. Figures are from Exhibit VIII-6. Comparison is between the annual cost of the FINAL Form (\$5.2 – \$13 million) and the annual cost of the EPA79 Form (\$6.9 – \$20.6 million).
3. U.S. Environmental Protection Agency, Office of Solid Waste, Economic Analysis Branch, “Regulatory Impact Analysis Proposed Standards for the Management of Used Oil,” Washington, D.C., November 1985; p. I-5. Figure represents the difference between the Grand Total costs for Full subtitle C regulations (\$525.3 million) and the Proposal (\$167.1 million) in Table I-2.

4. Ibid., p. I-8. The statement is based on the difference between the total cancer risk over 70 years for the Full Subtitle C regulations (6,064 cases of cancer) and the Proposal (6,016 cases) in Table I-5.
5. U.S. Environmental Protection Agency, Office of Solid Waste, "Regulatory Analysis for Final RCRA Rule for Certain Small Quantity Generators of Hazardous Waste," prepared by Industrial Economics, Inc., Cambridge, Massachusetts, December 1985, p. 6.17. Figure is from Exhibit 6-1 and is the difference between total annual costs for Option C-3 (\$222) and Option C-2 (\$188).

Chapter 5

1. U.S. Environmental Protection Agency, Office of Policy Analysis, "Costs and Benefits of Reducing Lead in Gasoline Final Regulatory Impact Analysis," EPA-230-05-85-006, Washington, D.C., February 1985, p. VIII-26. Figure is for "Net Benefits Excluding Blood Pressure" from the "No Misfueling" column of Table VIII-8.
2. U.S. Environmental Protection Agency, Office of Solid Waste, Economic Analysis Branch, "Regulatory Impact Analysis – Proposed Standards for the Management of Used Oil," Washington, D.C., November, 1985; p. I-5. The figure is the present value of the \$357 million cost savings realized each year for 70 years discounted at 10% interest. The \$357 million annual savings is the difference between the Grand Total Costs for Full Subtitle C regulations (\$559.1 million) and the proposal (\$201.9 million) in Table I-2.
3. U.S. Environmental Protection Agency, Economics and Technology Division, "Regulatory Impact Analysis for New Chemical Reporting Alternatives under Section 5 of TSCA," prepared by ICF Incorporated, Washington, D.C., May 10, 1983; p. 206. The figure is the present value of \$4 million cost savings realized each year for an indefinite period discounted at 10% interest. The \$4 million annual savings is the average difference between the annual cost of the EPA 79 Form (\$6.9 \$20.6 million) and the FINAL Form (\$5.2 \$13 million) as reported in Exhibit VIII-6.

Chapter 6

1. United States General Accounting Office, *Cost-Benefit Analysis Can be Useful in Assessing Environmental Regulations, Despite Limitations*, Report to the Congress of the United States by the Comptroller General (GAO/RCED-84-62), Washington, D.C., April 6, 1984.

2. See for example:

McGarity, Thomas D., *The Role of Regulatory Analysis In Regulatory Decision Making*, a Report Prepared for the Administrative Conference of the United States; Austin, Texas, 1985; and, V. K. Smith, ed., *Environmental Policy Under Reagan's Executive Order: The Role of Benefit-Cost Analysis*; University of North Carolina Press, Chapel Hill, N.C., 1984. See especially the article by W. Norton Grubb, Dale Whittington, and Michael Humphries,

“The Ambiguities of Benefit-Cost Analysis: An Evaluation of Regulatory Impact Analyses Under Executive Order 12291.”

3. U.S. Environmental Protection Agency, Office of Policy, Planning and Evaluation, Economic Analysis Division, *Improving RIAs: Suggestions for the Analysis of Hazardous Waste Regulations*, EPA-230-02-87-023, Washington, D.C., January 1987.
4. National Academy of Sciences, *Decision-Making for Regulating Chemicals in Our Environment*, 17-22 (1975); p. 484.
5. GAO; op. cit.
6. See Note #2.
7. Contract costs and FTE estimates have been obtained from EPA personnel familiar with the RIAs. In most cases, these were the RIA project officers, and their estimates were based on memory and on a brief examination of contract files.

The estimated cost of \$60,000 per FTE was obtained from EPA’s Office of Policy Analysis (OPA) and includes OPA’s estimate of approximately \$45,000 per FTE to cover salary, travel, benefits, etc., plus approximately \$15,000 per FTE to cover rent, electricity, telephones, and other agencywide overhead. Although these costs may vary from program to program, this estimate has been used to approximate EPA’s costs.

Appendix

Table A-1 U. S. Environmental Protection Agency RIAs Prepared for Major Rules
February 1981- February 1986

Table A-2 EPA's Compliance with EPA and OMB Guidelines For RIAs

Executive Summaries of RIAs Prepared by the U. S. Environmental Protection
Agency
February 1981 - February 1986

NAAQS for Nitrogen Dioxide	a
NAAQS for Particulate Matter	b
Surface Coal Mines	c
Heavy Duty Motor Vehicles	d
NAAQS for Carbon Monoxide	e
Lead in Fuels	f
Iron and Steel	g
Organic Chemicals	h
Asbestos	i
PCB Transformers	j
Premanufacture Review	k
Used Oil	l
Land Disposal of Hazardous Wastes	m
Oil Pollution Contingency Plan	n
Data Requirements for Registration of Pesticides	o

Table A-1

U. S. Environmental Protection Agency
RIAs Prepared For Major Rules
February 1981- February 1986

Act/Ria	Short Title	Date	EPA Office
Clean Air Act			
Regulatory Impact Analysis of the National Ambient Air Quality Standards for Nitrogen Dioxide	NAAQS - N02	2/85	Air
Benefits and Net Benefit Analysis of Alternative National Ambient Air Quality Standards for Particulate Matter	NAAQS -PM	3/83	Air
Regulatory Impact Analysis: Listing of Surface Coal Mines for New Source Review	Surface Coal Mines	2/86	Air
Regulatory Impact Analysis, Oxides of Nitrogen Pollutant Specified Study and Summary and analysis of Comments	Heavy Duty Motor Vehicles	3/85	Mobile Sources
Regulatory Impact Analysis of the National Ambient Air Quality Standards for Carbon Monoxide	NAAQS - CO	7/85	Air
Costs and Benefits of Reducing Lead in Gasoline: Final Regulatory Impact Analysis	Lead in Fuels	2/85	Policy Analysis
Clean Water Act			
Regulatory Impact Analysis of the Effluent Limitation Guidelines Regulation for the Iron & Steel Industry	Iron and Steel	3/82	Water
The Economic Benefits of the Proposed Effluent Limitations Guidelines for the Organic Chemicals and Plastics and Synthetic Fibers Industry	Organic Chemicals	1/83	Policy Analysis
Toxic Substances Control Act			
Regulatory Impact Analysis of Controls on Asbestos and Asbestos Products	Asbestos	8/85	Toxic Substances
Regulatory Impact Analysis of the Final Rule for Non-Substation PCB Transformers	PCBs	6/85	Toxic Substances
Regulatory Impact Analysis for New Chemical Reporting Alternatives under Section 5 of TSCA	Premanufacture Review	5/83	Toxic Substances

Table A-1 (cont'd)

**U. S. Environmental Protection Agency
RIAs Prepared For Major Rules
February 1981- February 1986**

Act/Ria	Short Title	Date	EPA Office
Resource Conservation and Recovery Act			
Regulatory Impact Analysis of Proposed Standards for the Management of Used Oil	Used Oil	11/85	Solid Waste
Regulatory Analysis of Proposed Restrictions on Land Disposal of Hazardous Wastes	Land Disposal	12/85	Solid Waste
Comprehensive Environmental Response, Compensation and Liability Act			
Regulatory Impact Analysis of the Revisions to the National Oil and Hazardous Substances Pollution Contingency Plan	Contingency Plan	2/82	Emergency & Remedial Response
Federal Insecticide, Fungicide and Rodenticide Act			
Regulatory Impact Analysis: Data Requirements for Registering Pesticides under the Federal Insecticide, Fungicide and Rodenticide Act	Data Requirements	8/82	Pesticides

Table A-2
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EPA's Compliance With EPA And OMB Guidelines For RIAs

Section 1

Statement of the Need and Consequences of the Proposal

Act/Rule	Identify Pollutants	Estimate Quantities	Describe Environmental Impact	Estimate Pollutant Reduction	Describe Environmental Benefits
Clean Air Act					
NAAQS - N02	X	X	X	X	X
NAAQS - PM	X	X	X	X	X
Surface Coal Mines	X	X	X	X	X
Heavy Duty Motor Vehicles	X	X	X	X	X
NAAQS - CO	X	X	X	X	X
Lead in Fuels	X	X	X	X	X
Clean Water Act					
Iron and Steel	X	X	X	X	X
Organic Chemicals	X	X	X	X	X
TSCA					
Asbestos	X	X	X	X	X
PCBs	X	X		X	X
Premanufacture Review	X	X	X		
RCRA					
Used Oil	X	X	X	X	X
Land Disposal		X		X	
CERCLA					
Contingency Plan					
FIFRA					
Data Requirements	X	X	X	X	X

Table A-2
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EPA's Compliance With EPA And OMB Guidelines For RIAs

Section 2

Identification of Alternatives

Act/Rule	Number of Alternatives Identified					
	Identify Baseline	Total	No Federal Regulations	Within Scope	Market Oriented	Beyond Scope
Clean Air Act						
NAAQS - N02	X	9	X	3	3	3
NAAQS - PM	X	10		10		
Surface Coal Mines	X	10	X	4	3	3
Heavy Duty Motor Vehicles	X	4		4		
NAAQS - CO	X	10	X	4	3	3
Lead in Fuels	X	8		6	2	
Clean Water Act						
Iron and Steel	X	15		13		2
Organic Chemicals	X	1		1		
TSCA						
Asbestos	X	10			10	
PCBs	X	4		4		
Premanufacture Review	X	4	X	4		
RCRA						
Used Oil	X	4		4		
Land Disposal	X	3	X	3		
CERCLA						
Contingency Plan	X	2		2		
FIFRA						
Data Requirements	X	9		5	1	3

Table A-2
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EPA's Compliance With EPA And OMB Guidelines For RIAs

Section 3

Analysis of Benefits

Act/Rule	Estimate				
	Identify Baseline	Ambient Impact	Exposure	Adverse Effects	Monetize Benefits
Clean Air Act					
NAAQS - N02	X	X			
NAAQS - PM	X	X	X	X	X
Surface Coal Mines	X	X	X	X	X
Heavy Duty Motor Vehicles	X	X	X	X	
NAAQS - CO	X	X	X	X	
Lead in Fuels	X	X	X	X	X
Clean Water Act					
Iron and Steel	X	X	X	X	X
Organic Chemicals	X	X	X	X	X
TSCA					
Asbestos	X	X	X	X	X
PCBs	X				X
Premanufacture Review	X		X		
RCRA					
Used Oil	X	X	X	X	
Land Disposal	X			X	
CERCLA					
Contingency Plan	X		X		
FIFRA					
Data Requirements	X		X	X	

Table A-2
(page 4 of 6)

EPA's Compliance With EPA And OMB Guidelines For RIAs

Section 4

Analysis of Costs

Act/Rule	Estimate Costs				
	Baseline	Real Resource	Government Costs	Welfare Losses	Adjustment Costs
Clean Air Act					
NAAQS - N02	X	X	X	X	X
NAAQS - PM	X	X	X		
Surface Coal Mines	X	X			
Heavy Duty Motor Vehicles		X			
NAAQS - CO	X	X	X	X	X
Lead in Fuels	X	X			
Clean Water Act					
Iron and Steel	X	X			
Organic Chemicals	X	X			
TSCA					
Asbestos	X	X		X	X
PCBs	X	X			
Premanufacture Review	X	X	X		
RCRA					
Used Oil	X	X			
Land Disposal	X	X			
CERCLA					
Contingency Plan	X	X	X		X
FIFRA					
Data Requirements	X	X	X	X	X

Table A-2
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EPA's Compliance With EPA And OMB Guidelines For RIAs

Section 5

Evaluation of Net Benefits

Act/Rule	Net Benefits	Distribution	Economic Impacts	Cost-Effectiveness
Clean Air Act				
NAAQS - N02			X	X
NAAQS - PM	X	X	X	
Surface Coal Mines	X		X	
Heavy Duty Motor Vehicles			X	X
NAAQS - CO			X	X
Lead in Fuels	X	X	X	
Clean Water Act				
Iron and Steel	X		X	X
Organic Chemicals	X		X	X
TSCA				
Asbestos		X	X	X
PCBs	X	X	X	X
Premanufacture Review			X	X
RCRA				
Used Oil			X	X
Land Disposal			X	
CERCLA				
Contingency Plan		X	X	
FIFRA				
Data Requirements			X	

Table A-2
(page 6 of 6)

EPA's Compliance With EPA And OMB Guidelines For RIAs

Section 6

Rationale for Choosing the Proposed Action

Act/Rule	Reasons for Choosing Action	Legal Constraints to Maximize Benefits	Statutory Authority
Clean Air Act			
NAAQS - N02	X	X	X
NAAQS - PM	X		X
Surface Coal Mines	X	X	X
Heavy Duty Motor Vehicles			X
NAAQS - CO	X	X	X
Lead in Fuels	X		X
Clean Water Act			
Iron and Steel	X	X	X
Organic Chemicals	X		X
TSCA			
Asbestos	X		X
PCBs	X		X
Premanufacture Review	X		X
RCRA			
Used Oil	X		X
Land Disposal	X	X	X
CERCLA			
Contingency Plan	X		X
FIFRA			
Data Requirements	X	X	X

NAAQS For Nitrogen Dioxide

Regulation

NO₂ is an air pollutant generated by the oxidation of nitric oxide (NO), which is emitted from both mobile and stationary sources. At elevated concentrations, NO₂ can adversely affect human health, vegetation, materials, and visibility. Nitrogen oxide compounds (NO_x) may also contribute to increased rates of acidic deposition.

The Clean Air Act provides authority for EPA to set National Ambient Air Quality Standards (NAAQS) for NO₂. The NO₂ NAAQS established in 1971 were reviewed and, in 1984, EPA proposed to retain the existing annual average standards and specifically requested comment on whether a separate short-term standard is requisite to protect human health.

The Clean Air Act requires that the NAAQS be based on scientific criteria relating to the level of air quality needed to protect public health and welfare. EPA did not consider the results of this RIA in selecting the proposed NAAQS.

Regulatory Alternatives

The following alternative approaches to regulation were considered in this RIA:

1. Technology-based emission standards.
2. Regional air quality standards.
3. Alternate stringency levels (ranging from 0.053 ppm to 0.07 ppm), and alternate implementation schedules.
4. Market-oriented alternatives.
5. No regulation.

Only alternate stringency levels were studied in detail in this RIA and only they were considered in the Agency's development of the standard.

Environmental Effects

A variety of respiratory system effects have been reported to be associated with exposure to NO₂ concentrations less than 2.0 ppm in humans and animals, including altered lung function, and respiratory illness and lung tissue damage. Welfare effects of NO₂ in the atmosphere include materials damage, reduced productivity of crops, reduced visibility, and climate changes. The revised NO₂ NAAQS are intended to improve air quality and thereby reduce the above adverse effects.

Benefits

Benefits were not monetized for this RIA; instead, benefits were represented by the reductions of NO₂ that are obtained under different NO₂ standards.

Costs

This RIA emphasized the direct principal, or real-resource, costs associated with controlling emission sources of nitrogen oxides (NO_x) air pollution in order to attain alternative nitrogen dioxide (NO₂) NAAQS. Costs were estimated for controls necessary to attain the alternative NAAQS by 1985 and 1990. The costs, in constant 1984 dollars, included inspection and maintenance of motor vehicle costs (I&M) and stationary source control costs.

Other costs included are those incurred to meet:

1. The Federal Motor Vehicle Control Program (FMVCP) for automobile and truck NO_x controls, as governed by the Clean Air Act; and
2. New source performance standards (NSPS) for certain new large point sources of NO_x emissions, also governed by CAA.

The discounted present value of the total estimated nationwide costs for the alternative NO₂ NAAQS for 1985 attainment ranged from \$1,950 million to \$1,840 million for 1 gpm FMVCP, \$1,730 million to \$1,590 million for 1.5 gpm FMVCP, and \$1,700 million to \$1,560 million for 2.0 gpm FMVCP. For 1990 attainment, these costs were \$2,670 million for 1 gpm FMVCP, \$1,750 million for 1.5 gpm FMVCP and ranged from \$1,640 million to \$1,630 million for 2.0 gpm FMVCP.

Benefit-Cost Analysis

A traditional benefit-cost assessment was not made in this RIA. Instead, analyses of the incremental costs to reduce potentially adverse concentrations of NO₂ were performed. This was calculated from the incremental control costs and the incremental NO₂ concentrations resulting from more stringent NO₂ standards to yield an estimate for the incremental costs per concentration reduction between standards.

The incremental costs per NO₂ concentration reduction in 1985 ranged from \$0 to \$17.1 million for 1.0 gpm FMVCP, \$5 to \$55 million for 1.5 and 2.0 gpm FMVCP; the incremental costs for 1990 were zero in every case, except for reduction from 0.60 to 0.53 ppm for 2.0 gpm FMVCP, where they were \$2 million.

Distributional Effects

EPA has concluded that the following groups are particularly sensitive to low-level NO₂ exposures and therefore would gain the greatest benefit from the control of NO_x emissions:

1. Young children,
2. Asthmatics,
3. Individuals with chronic bronchitis, and
4. Individuals with emphysema and other chronic respiratory diseases.

Economic Impact Analysis

No plant closings were expected due to the installation of NO_x controls to meet any of the annual average NO₂ NAAQS. None of the proposed NO₂ NAAQS would have a significant impact on product price, capital availability, or import substitution. At most, a NO₂ NAAQS would add 0.020% to the cost of producing goods. Also, the average per vehicle cost of I&M for a failed vehicle – approximately \$23 – was not considered a significant increment in the annual cost of vehicle operation for either the commercial or industrial sectors. The analysis, therefore, predicted no major changes in industry market structure and no significant effect on small business entities.

Decision

As a result of its review and revision of the health and welfare criteria associated with NO₂, EPA promulgated a rule retaining the existing primary and secondary standards of 0.053 ppm as an annual arithmetic average. The RIA was not considered in the Agency's decision. The decision on the need, if any, for a separate short-term standard is being deferred pending the results from additional research focused on reducing the uncertainties associated with short-term health effects.

NAAQS For Particulate Matter

Regulation

Particulate matter (PM) represents a broad class of diverse substances that exist as discrete particles and are emitted to the atmosphere from a wide variety of sources. At elevated concentrations PM can adversely affect human health and welfare.

The Clean Air Act provides authority for EPA to set National Ambient Air Quality Standards (NAAQS) for PM. The PM NAAQS established in 1971 were reviewed and new NAAQS were proposed in 1984.

The Clean Air Act requires that the NAAQS be based on scientific criteria relating to the level of air quality needed to protect public health and welfare. EPA did not consider the results of this RIA in selecting the proposed NAAQS.

Regulatory Alternatives

In reviewing the PM NAAQS, EPA considered a range of ambient concentrations for PM₁₀. PM₁₀ refers to particles with an aerodynamic diameter less than or equal to 10 μm . The ambient levels considered for PM₁₀ included both a range of annual arithmetic means from 48 to 70 $\mu\text{g}/\text{m}^3$ and a range of 24-hour expected 2nd maximum values from no standard to 150 to 250 $\mu\text{g}/\text{m}^3$. The existing standards for Total Suspended Particulates (TSP) were also considered.

Environmental Effects

Scientific research suggests that reducing ambient PM concentrations would have beneficial effects both on human health and on the physical environment. Reduced PM concentrations may lead to reductions primarily in the incidences of respiratory and cardiovascular diseases. Also, reduced PM concentrations may lead to less soiling of property, less acidic deposition, and an improvement in visibility.

Benefits

EPA used existing health and welfare studies to obtain information about the benefits of reducing PM concentrations. Benefit estimates were included for all categories of effects for which adequate studies were available. In aggregating the benefits across the various categories of effects EPA used six different aggregation procedures (A-F). Aggregation procedures A and B were based only on those studies which had gone through the Criteria Document and CASAC review process and were found to provide quantitative evidence of effects. The other procedures incorporated progressively more studies and consequently more benefit categories, even though some of these studies were exposed to lesser degrees of review or consensus.

The effects considered in the benefit estimates for aggregation procedure A and B included reductions in human mortality and morbidity. The aggregation procedures C and D added the benefits of reduced soiling and material damage in the household sector. Aggregation procedures E and F added the benefits of reduced soiling and material damage in the manufacturing sector. For several categories of effects, such as soiling and materials damage in the other sectors,

adequate studies could not be identified. These categories of effects were not included in the benefit estimates.

The benefits of the alternative PM NAAQS were aggregated from the estimated attainment dates (1987 or 1989) through 1995 and were monetized using two estimates (\$0.36 and \$2.80) of the value of a unit reduction of 1.0×10^{-6} in annual mortality risk. These estimates were provided as a range of estimates from studies of what individuals are willing to pay for such a reduction in mortality risk. The total estimated benefits ranged from about \$0.5 - \$6.0 billion for aggregation procedure A to about \$40 - \$270 billion for aggregation procedure F.

Costs

Costs for the alternative PM NAAQS were estimated by preparing a list of control options and associated costs for each source in those counties projected to be in nonattainment. Where the control strategies did not result in full attainment, the additional cost of attainment was estimated by extrapolation using average national costs.

The discounted present value of the total estimated nationwide costs for the alternative PM NAAQS ranged from \$1.4 billion to 11.0 billion.

Benefit-Cost Analysis

The benefits and costs for each alternative PM NAAQS were aggregated to yield estimated net incremental benefits. Using aggregation procedure A the net benefits were negative for all of the alternatives when the lower value of reducing mortality risk was used and ranged up to about \$1 billion using the higher value of reducing mortality risk. Using aggregation procedure F the net benefits ranged from about \$40 - \$260 billion.

Distributional Effects

The benefits of reduced PM concentrations were found to vary considerably among different regions of the country. Particularly large shares of the benefits were noted in Regions V (East North Central), VI (South Central) and IX (South Pacific). The share of the benefits changes depending on the aggregation procedure used. For example, Procedure A for the PM₁₀ (70/250 $\mu\text{g}/\text{m}^3$) standard suggests that 54% of the benefits would occur in Region IX. Under Procedure E, the share for Region IX falls to 32% and is exceeded by the 35% share in Region V.

Economic Impact Analysis

The most stringent PM NAAQS resulted in the imposition of costs on some 200 industries. Because it was not feasible to complete an economic analysis of all affected industries, sixteen industries that were judged particularly vulnerable to these costs were analyzed.

The incremental costs of the most expensive PM NAAQS alternative were applied to pro forma income statements and balance sheets developed for model plants in each industry. For 10 of the 16 industries, absorption of the control costs with no price changes or net adjustment to

production was projected to result. Firms in the remaining industries were judged able to pass through a significant portion of the control costs resulting in price increases ranging from 0.6% to 7.0% with resulting net decreases in production no greater than 1.0%. Although the impacts were found to vary by industry, the analysis forecast neither major change in production or industry structure, nor a significant effect on a substantial number of small business entities.

Decision

As a result of the review and revision of the health and welfare effects associated with PM, EPA proposed to replace TSP and PM₁₀ as an indicator for the primary PM NAAQS. The RIA was not considered by the Agency in formulating the proposal. The 24-hour primary NAAQS was proposed to be selected from a range of 150 to 250 ug/m³ and the annual primary standard was proposed to be selected from a range of 50 to 65 ug/m³ expressed as an annual arithmetic mean. A 24-hour secondary NAAQS was proposed to be selected from a range of 70 to 90 ug/m³ of TSP expressed as an annual arithmetic mean. The Administrator invited comments and information from the public for consideration in promulgating the specific levels for each of the standards.

Surface Coal Mines For New Source Review

Regulation

EPA has various rules that regulate the construction of new stationary sources of air pollution and modifications in existing sources. EPA has proposed to list surface coal mines (SCMs) as a source category subject to the new Source Review (NSR) provisions of the Clean Air Act (CAA). This action would limit particulate matter (PM) emissions of SCMs and result in reductions in PM concentrations beyond those that can be achieved under the existing or revised PM National Ambient Air Quality Standards (NAAQS) and state regulations. PM represents a broad class of diverse substances that exist as discrete particles. At elevated concentrations, PM can adversely affect human health and welfare.

The CAA allows for the consideration of economics as one of the criteria in making a final decision with regard to the proposed rulemaking.

Regulatory Alternatives

Alternative I: No further regulations beyond PM NAAQS and state regulations.

Alternative II: Would affect SCMs starting construction after promulgation of the regulation; existing SCMs would be exempted from NSR.

Alternative III: Would affect new and existing SCMs that started construction after January 6, 1975.

Alternative IV: As major sources, mines would be subject to the CAA's prevention of significant deterioration (PSD) increments. Allowable CAA and State PSD increments include Class I through III designations, which represent increasing levels of air quality degradation that are allowable. Alternative IV would affect only those SCMs whose operations would have ambient impacts on Class I and mandatory Class II lands.

Other alternatives required to be considered by E.O. 12291 included:

1. No additional regulation.
2. Regulations beyond the scope of present legislation.
3. Market-oriented approaches.
4. Alternative stringency levels.

Statutory requirements preclude consideration of 1, 2 and 4. This RIA did not attempt to identify optional strategies that states may undertake to comply with alternative regulations.

Environmental Effects

Reducing ambient PM concentrations has been found to have beneficial effects both on human health and on the physical environment. Human health is improved by reductions in the incidences of cancer and of respiratory and cardiovascular diseases. Reduced PM concentrations also lead to less soiling of property, less acidic deposition, and an improvement in visibility.

To estimate improvements in air quality due to regulation, baseline PM concentrations associated with individual mines were computed and dispersion modeling was then performed to obtain maximum off-site concentrations contributed by a mine. The difference between the baseline off-site concentration and the PSD increment was then determined to yield the level of air quality improvement attributable to the alternative regulations.

Under Alternative II, annual average PM concentrations were estimated to decrease between zero and 33.9 ug/m³, while 24-hour concentrations decreased between zero and 84.0 ug/m³. Under Alternative III, the annual average improvement ranged from 3.2 ug/m³ and 51.1 ug/m³. The range for the 24-hour improvements was 0.3 to 57.1 ug/m³. Under Alternative IV, visibility in Class I and mandatory Class II was estimated to improve from 0.5 to 18.2 miles.

Benefits

EPA used existing health and welfare studies to obtain information about the benefits of reducing PM concentrations. The benefit estimates in this RIA represented the incremental improvement in going from an air quality level due to PM NAAQS regulations to an air quality level consistent with PSD increments.

Benefit categories analyzed included morbidity, mortality, household soiling and materials damage, visual range and plumeblight. Benefits for these categories were quantified by measuring individuals' willingness-to-pay (WTP) for cleaner air. Ranges of benefits for new mines were calculated by making alternative assumptions with regard to the population exposed.

The range of benefits for five basins analyzed under Alternative II was \$25,200 to \$815,900, estimated for 1995. The range of benefit estimates, for Alternative III, also for 1995, was only for the Powder River Basin and was from \$109,000 to \$242,200. (Under Alternative II, the Powder River benefits ranged from zero to \$33,200.) The benefit ranges for Alternative IV were zero to \$303,200 and zero to \$13,600 for Bryce Canyon National Park (for 1996), and Chaco Culture National Historic Park (for 1989), respectively. (Under Alternative 4, only benefits related to visibility were measured because neither park had large enough permanent populations to generate residential benefits.) Benefits were measured in 1983 dollars using a 10% discount rate.

Costs

Engineering costs associated with air quality improvement over and above the costs of current control programs were calculated in this RIA for individual mines. Emission control costs were estimated by costing-out additional equipment. A surface mine production cost model was used to compute changes in the cost of production arising from forced reductions in output rates.

Under Alternative II, mine cost increases ranged from zero to \$5.51 per ton of coal produced. For Alternative III, engineering costs ranged from \$0.015 to \$0.81 per ton of coal. Since mines were not expected to locate near Class I and mandatory Class II areas under Alternative IV, no engineering cost estimates were expected.

Benefit-Cost Analysis

The benefit-cost analysis described comparisons across alternatives on the basis of incremental benefits and incremental costs. For Alternative II, the largest incremental net benefit was \$-4.6 million for the five basins; for Alternative III, the largest incremental net benefit was \$-5.7 million for the Power River Basin. (For the Power River Basin, maximum incremental net benefits under Alternative II were estimated to be \$-199,000.) Under Alternative IV, the maximum benefits in the two areas studied were about \$300,000. Alternative IV is therefore the most economically efficient alternative.

Distributional Effects

All new mines were assumed to locate in isolation and away from existing populations. The hypothetical population that was expected to be affected by PM emissions of mines included mine employees, their families, employees of secondary businesses supporting the mining activity and families of these latter employees.

Economic Impact Analysis

Economic impacts measured in this RIA included market price, changes in production rates and social costs of the alternatives. As the alternative regulations impose costs on new SCMs entering the market, market prices increase, surface production declines and deep coal production increases in basins where the two technologies compete. The market price increases caused by adopting Alternative II ranged from zero to \$4.87 per ton of coal.

The price impacts of Alternative III ranged from \$0.01 to \$0.75 per ton (Powder River price impacts would be the same under either alternative). Alternative IV was asserted to have no impacts on any regional market or on the national level.

Price increases would lead to reduced basin output of surface mined coal. Under Alternative II, these reductions would range from 2.6 to 29.5 million tons of surface coal summed across all basins analyzed. Reduced surface coal output in the Power River Basin under both Alternatives II and III ranged from 0.1 to 5.3 million tons of coal. In the two eastern basins analyzed under Alternative II, underground coal production would go up, ranging from increases of 1.6 to 13.5 million tons.

Social costs represent increased costs of production due to regulation and costs associated with decreases in coal production due to price increases. The social cost estimate of Alternative II ranged from \$5.4 million to \$68.2 million. Under Alternative III, the Powder River Basin social costs ranged from \$5.9 million to \$15.5 million. (Under Alternative II, Powder River social costs ranged from \$0.2 million to \$11.6 million.)

Regulation will primarily affect large mining operations and will not have a significant impact on a substantial number of small entities.

Decision

EPA has proposed to add surface coal mines to the current list of 30 categories of sources subject to the New Source Review provisions of the Clean Air Act. None of the alternatives presented in this RIA has yet been chosen by EPA for promulgation. The Administrator has invited comments and information from the public for consideration in promulgating a final rule.

This RIA was prepared for use in assisting the Administrator in making his decision on the final action on listing SCMs.

Heavy Duty Motor Vehicles

Regulation

The final rule associated with this RIA regulates, for 1988 and later model years, the level of emissions of nitrogen oxides from light-duty trucks (LDTs) and heavy-duty engines (HDEs) and the level of particulate emissions from heavy-duty diesel engines (HDDEs). The lower level of NO_x and PM in the ambient air attained by this regulation (compared to uncontrolled emissions) is anticipated to have a beneficial effect on human health and welfare.

The Clean Air Act Amendments of 1977 created a statutory heavy-duty vehicle class and established mandatory emissions reductions for that class. Under the amendments, all heavy-duty vehicles were required to achieve a 75 percent reduction in NO_x emissions from uncontrolled levels, effective with the 1985 model year. The Act also authorized the Administrator to temporarily establish revised NO_x standards for heavy-duty engines if the statutory standards could not be achieved without increasing cost or decreasing fuel economy to an “excessive and unreasonable degree.”

The Amendments of 1977 also required the “greatest degree of particulate emission reduction achievable,” given the availability of control technology and considering cost, leadtime and energy impacts. These reductions were to begin in the 1981 model year. The heavy-duty diesel engine particulate standards in this rulemaking were based on this authority.

Technological feasibility was the primary basis for the decision in this rulemaking because of the statutory provisions governing both the NO_x and particulate standards. Cost effectiveness was a lesser consideration in deciding among control options.

Regulatory Alternatives

A range of alternative emissions standards were considered for LDTs, HDEs and HDDEs. Technical difficulty, cost, and cost effectiveness values were determined for each alternative.

Environmental Effects

EPA used a “rollback model” to predict future air quality: In this approach, any change in emissions was assumed to translate proportionately into a change in ambient pollutant concentrations. The final rule’s standards for NO_x emissions were tested in eight low-altitude urban areas resulting in 5% lower ambient concentrations of NO₂ than base case predictions in 1990 and 11% lower in 1995. In two high-altitude urban areas, NO₂ concentrations were 4% lower than for the base case in 1990 and 11% lower in 1995.

Diesel particulate emissions are almost exclusively composed of fine particulates and, because they occur at ground level, lead to high ambient concentrations. Current ambient diesel particulate concentrations in large cities are projected to grow from an average of 1-3 ug/m³ to levels of 3-7 ug/m³ by the year 2000 with no further control on HDDEs. With the standards promulgated in the final rule, diesel particulate concentrations in large cities will be reduced to 1.5-4 ug/m³, a reduction to almost half of baseline concentrations.

It has been determined that reducing ambient concentrations of NO₂ will reduce the incidence of human respiratory problems. Reducing ambient diesel PM concentrations will lower the risks of cancer and non-cancer health problems; diesel PM reduction will also lead to improved visibility and reduced soiling of property.

Benefits

Because of a court-imposed deadline, the Office of Mobile Sources did not include in the final RIA those sections of the draft RIA that remained unchanged. However, the final RIA makes clear that these sections are meant to be part of the total economic analysis within its purview. These sections include a benefit-cost analysis of HDDE PM emissions.

Health and welfare benefits for a .25 g/BHP-hr particulate standard totaled \$6625 million, and for a .10 g/BHP-hr standard totaled \$9455 million. (These values are in 1983 dollars and represent the 1987-2000 interval.)

Annual benefits were also calculated for all six HDDE particulate control options under consideration. The benefits ranged across alternatives for a lower bound of \$117 million and an upper bound of \$1977 million to a lower bound of \$240 million and an upper bound of \$4082 million.

Costs

The aggregate costs to the nation of the HDE NO_x and particulate standards included the total manufacturer costs of research, development and testing (RD&T), hardware, and user costs of fuel economy and maintenance incurred as a result of the standards. These costs were estimated to be \$118-600 million for the 1988 standards, \$833-1,241 million for the 1991 standards, and \$336-394 million for the 1994 standards, discounted at 10% to each of those years.

The control costs for particulate emissions of PM were calculated separately as part of the benefit-cost analysis of particulate control. For the .25 g/BHP-hr standard, the lower bound cost was \$1788 million and the upper-bound \$2986 million, for the .10 g/BHP-hr standard, the lower bound was \$2554 million, the upper bound \$4266 million. (These values are in 1983 dollars and represent the 1987-2000 interval.)

Annual costs were also calculated for all six HDDE particulate control options under consideration. These costs ranged across alternatives from a lower bound of \$113 million and an upper bound of \$189 million to a lower bound of \$347 million and an upper bound of \$579 million.

Benefit-Cost Analysis

EPA determined the cost-effectiveness of the proposed standards in terms of the dollar cost per ton of particulate or NO_x emissions controlled over and above less stringent options. These values were used to make comparisons with the cost-effectiveness of other mobile and

non-mobile source control strategies. The costs represent the net present value in the year of sale to the consumer, using a 10% discount rate. Cost-effectiveness analysis of the NO_x standards for LDTs yielded a \$405/ton figure, \$35/ton for HDE option of 6.0 g/BHP-hr in 1988 and \$58-122/ton for the HDE option of 6.0 g/BHP-hr in 1988 and 5.0 g/BHP-hr in 1991. For the diesel PM standards, the cost-effectiveness figure for the option of .60 g/BHP-hr in 1988 was \$2710/ton, for the option of .60 g/BHP-hr. in 1988 and option of .60g/BHP-hr in 1988, .25 g/BHP-hr in 1991 and .10g/BHP-hr in 1994, the figure was \$10,300-11,900/ton. All of the above figures assume a 10% discount rate for the calculation of tons of PM reduced.

Benefit-cost analyses were performed for six regulatory options for particulate emissions from heavy-duty vehicles. The net benefits ranged across alternatives from a lower bound of -\$74 million and an upper bound of \$1863 million to a lower bound of -\$339 million and an upper bound of \$3735 million.

Cost-effectiveness figures were also obtained for other mobile source control alternatives for NO_x and PM as well as for stationary source control alternatives for PM. Based on these analyses, the final standards appear to be a relatively cost-effective means of reducing particulate and NO_x emissions compared to controlling these pollutants from other sources.

Distributional Effects

Because emissions of NO_x and PM result in different ambient concentrations at high and low altitudes, high and low altitude areas are considered separately when developing emission standards.

Economic Impact Analysis

Besides the costs mentioned above incurred by industry and vehicle purchasers as a result of the HDE NO_x and particulate standards, the original draft RIA discussed the effects on manufacturer sales and cash flow, the regional effects of employment, and the national effects on energy usage, balance of trade and inflation. The final RIA does not go over the results of these analyses, but does review some comments received from individuals and organizations. EPA agrees with these comments that the costs of regulation will be passed on to the consumer in terms of price increases but deems that these costs will be considered worthwhile, considering the benefits incurred of improved environment and public health.

Comments were received pertaining to the impact of the rule on urban transit buses. EPA estimated that the costs borne by these transit systems, at approximately 5% increase in first price and 2% increase in operating and maintenance costs, would not be severe and there should be no significant fare increases or ridership losses.

There is no analysis in the final RIA of the effects of the rule on small business entities.

Decision

EPA's new oxides of nitrogen emission standards for 1988 and later model year LDTs are 1.2 or 1.7 g/mile, depending on vehicle test weight; for 1988 and later model year HDEs, 6.0 g/BHP-hr (the D.C. Circuit Court has since ruled (Nov. 7, 1986) that this standard cannot take effect until 1990); and for 1991 and later model year HDEs, 5.0 g/BHP-hr. The new particulate emissions standards, which apply only to HDDEs, are .60 g/BHP-hr for 1988 and later model years, .25 g/BHP-hr (.10 g/BHP-hr for urban buses) for 1991 and later model years, and .10 g/BHP-hr for 1994 and later model years. Emissions averaging, of both particulate and NO_x emissions from HDEs, is allowed beginning with the 1991 model year. Averaging of NO_x emissions from LDTs is allowed beginning in 1988. Comments on inter-company trading of HDT emissions of NO_x and PM were solicited as a possible future regulatory initiative.

EPA held two public hearings following the proposal of NO_x and particulate standards and invited comments, which were reviewed and incorporated into the final RIA.

NAAQS for CO

Regulation

Carbon monoxide is a colorless, odorless gas that is toxic to mammals, causing deficient oxygenation of the blood, which leads to malfunction of cardiovascular, central nervous, pulmonary and other body systems. Low-level CO exposures have been shown to cause aggravation of cardiovascular diseases.

The Clean Air Act provides authority for EPA to set National Ambient Air Quality Standards (NAAQS) for CO. Primary and secondary CO NAAQS established in 1971 were reviewed and new NAAQS were proposed in 1980. Since CO at the level found in the ambient air does not have any adverse effects on vegetation or the public welfare, EPA is revoking the existing secondary standard. Consequently, this RIA focused on the primary standards only.

The Clean Air Act requires that the NAAQS be based on scientific criteria relating to the level of air quality needed to protect public health and welfare. EPA did not consider the results of this RIA in selecting the proposed NAAQS.

Regulatory Alternatives

Executive Order 12291 requires that at a minimum, the following regulatory alternatives be examined:

1. No regulation.
2. Regulations beyond the scope of present legislation.
3. Market oriented alternatives.
4. Alternative stringency levels and implementation schedules.

Because of legislative constraints, only alternative stringency levels were analyzed in detail in this RIA. These alternative CO levels for the 8-hour primary standard ranged from 9ppm to 15ppm.

Environmental Effects

Reducing ambient CO concentrations would have beneficial effects on human health. Low-level exposure to CO can cause aggravation of angina and other cardiovascular diseases and can have adverse effects on the central nervous system.

Benefits

Benefits were not monetized for this RIA; instead, benefits were represented by the number of occurrences of carboxyhemoglobin (COHb) levels of 2.1 percent or higher among American adults with cardiovascular disease. These numbers were derived by linking up the Coburn model with outputs of the national exposure model to estimate COHb distributions in sensitive adults that would be exposed to various ambient CO levels under the alternative standards. These numbers ranged from 12,570 occurrences under the 9 ppm standard to 15,476,000 occurrences under the 15 ppm standard.

Costs

This RIA emphasized the direct principal, or real-resource, costs associated with controlling emission sources of CO air pollution in order to attain alternative CO NAAQS. This RIA discussed the cost estimate for NAAQS attainment by 1995. The costs, in constant 1984 dollars, are those associated with reasonably available control measures (RACM), which form the basis for the state implementation plans which are developed to attain and maintain NAAQS. RACM include inspection and maintenance programs for automobiles (I & M), transportation control measures (TCM) and point source-oriented technologies. However, since the RACM does not result in full attainment of the CO NAAQS, four additional alternative control strategies were investigated.

These resulted in annual costs ranging across alternative ambient CO concentration standards from \$44 - 58 million to \$261 - 338 million.

Benefit-Cost Analysis

A traditional benefit-cost assessment was not made in this RIA. Instead, analyses of the incremental costs and of reduced potentially adverse exposures to CO were performed instead. Costs associated with the four alternative standards were analyzed along with reductions in the number of sensitive people with COHb levels exceeding 2.1 percent and reductions in the number of occurrences of COHb levels exceeding 2.1 percent. The incremental costs per exposure reduction ranged from \$47 - \$72 to \$7,980 - \$14,500 per reduction in the number of cardiovascular adults exceeding 2.1 percent COHb and ranged from \$4 - \$6 to \$3,140 - \$5,850 per reduction in the number of occurrences of COHb levels exceeding 2.1 percent.

Distributional Effects

EPA has identified persons with angina or other types of cardiovascular disease as the groups at greatest risk from low-level, ambient exposures to CO. Other susceptible groups include:

1. Persons with chronic respiratory disease.
2. Elderly individuals, especially those with reduced cardiopulmonary function.
3. Fetuses and young infants.
4. Persons suffering from anemia and/or those with abnormal hemoglobin types that affect oxygen carrying capacity or transport in the blood.

Economic Impact Analysis

No plant closings or significant unemployment impacts were predicted due to the installation of CO controls. None of the proposed CO NAAQS would have a significant impact on product price, capital availability, or import substitution. For large industrial sources, CO capital expenditures would be, at most, 8 percent of projected capital expenditures, resulting in price

changes of no more than 0.5 percent. The analysis, therefore, predicted no major changes in industry market structure and no effect on small business entities.

Decision

As a result of its review of the health and welfare criteria associated with CO, EPA decided to retain the existing primary (health) standards for CO established in 1971, of 9 parts per million (ppm) for the 8-hour average and 35ppm for the 1-hour average, and revoked the existing secondary (welfare) standards. The Agency did not consider the RIA in reaching this decision.

Lead in Gasoline

Regulation

The EPA is regulating the level of lead in gasoline in order to minimize the adverse health and environmental effects of subsequent ambient air lead levels and of increased emissions of other pollutants due to catalytic converters damaged by leaded gasoline. The Clean Air Act provides authority for EPA to control a fuel additive if its emission products cause or contribute to air pollution endangering “the public health or welfare...or impairing...the performance of any emission control device or system...in general use.”

The benefits and costs of alternative lead phasedown rules were included among the considerations made in setting the final standard.

Regulatory Alternatives

In reviewing the lead in gasoline standard, EPA considered a range of alternative phasedown schedules. These alternatives included both different lead levels and different effective dates. Market-oriented alternatives to regulation were also considered.

Environmental Effects

Lead in gasoline has been shown to increase blood lead levels, which in turn have been linked to a variety of serious health effects. Exposure to high levels of lead in the air may lead to severe retardation, kidney disease, and even death; lower levels of lead provoke biochemical changes, with uncertain implications for health. Particular concern has focused on children, who appear to be at greater risk. A reduction in the level of lead in gasoline will significantly reduce the incidence of these health problems. Also as a result of the lead standard, excess emissions of hydrocarbons, carbon monoxide and nitrogen oxides that result from misfueling will be reduced to the extent that misfueling is reduced. Other benefits of the lead in gasoline standard include vehicle maintenance savings, improved fuel economy, and increased engine durability.

Benefits

Monetized benefits of the final rule were estimated for three categories: (1) Children’s health benefits associated with reduced lead exposure; (2) Benefits from reduced emissions of hydrocarbons, nitrogen oxides, and carbon monoxide from misfueled vehicles; and (3) Maintenance and fuel economy savings. In each category, estimates did not cover all the likely benefits, because of gaps in the data or difficulty in monetizing some types of benefits.

1. Benefits from reduced lead exposure in children included estimates of medical costs averted, amounting to \$155 million in 1986. Estimates were also made of compensatory education costs averted for children experiencing learning difficulties due to elevated blood lead levels; for 1986, these benefits amounted to \$447 million.
2. Benefits from reducing emissions of pollutants other than Lead were estimated using two methods. The first method used direct estimates of health and welfare effects, e.g.,

the effects of ozone (formed by HC and NO_x) on agricultural crop losses and on days lost from work due to respiratory symptoms; these benefits ranged in 1986 from a low estimate of \$113 million to a high estimate of \$305 million, with a point estimate of \$171 million. The second method used the cost of pollution equipment destroyed by misfueling, yielding an estimate of \$385 million saved for 1986. The final estimate was based on an average of these two methods.

3. Assuming no misfueling, the estimates of maintenance benefits were \$933 million for 1986. Estimates of fuel economy savings, mostly due to higher fuel density, were \$190 million for 1986.

Costs

A reduction in the standard from 1.10 grams of lead per gallon of gasoline (gplg) to 0.50 gplg, effective in July 1985, raised the cost of producing an octane-barrel of gasoline from 15.8 cents to 20.4 cents. (An octane-barrel is defined as raising the octane of a barrel of gasoline by 1 point.) Annually, the cost to the industry is \$96 million. A standard of 0.10 gplg effective January 1, 1986 will cost the industry \$3.4 billion for the period 1986-92.

Benefit-Cost Analysis

The benefits and costs for alternative lead level standards were aggregated to yield estimated net benefits. Assuming no misfueling starting in 1985, the net benefits of the proposed rule for the period 1985-92 were estimated to be \$6.7 billion. The benefits calculated do not include benefits from averting elevated blood pressure in adults due to elevated blood lead levels, because studies establishing this link are too recent to allow widespread review. Whether or not blood pressure data was used, and whether or not it was assumed that the rule would eliminate misfueling, the results showed that the final phasedown rule had the highest net benefits of the alternatives considered.

Distributional Effects

Harmful effects to human health due to elevated blood lead levels occur in all segments of the population but are most prevalent in children. Blood lead levels are higher in summer than in winter; the gasoline lead variable that best correlates with blood lead is gasoline sales for the preceding month.

To determine regional differences in industry costs, the national model of costs was disaggregated by geographic location. It was found that the rule would cause fewer operating constraints in the West Coast, Alaska and Hawaii than in the rest of the country as the rule generates lower operating rates and marginal costs for producing octane in these areas.

Economic Impact Analysis

EPA used the Department of Energy linear programming model of the refining industry to estimate the costs of complying with the lead phasedown rule. This model estimated that at current lead levels (1.10 gplg) the increase in manufacturing costs between leaded and unleaded gasoline was less than 2 cents per gallon. Retail prices diverged by an average of about 7 cents per gallon. This large discrepancy reflects marketing strategies within the retail industry rather than real social costs, defined as the costs of real resources such as extra capital and labor.

Increases in manufacturing costs were moderated in 1985 by the option for industry to use marketable "lead credits." Under the 1.10 gplg limit, industries with lower than average costs to produce octane without lead were allowed to reduce their lead content below the limit and to sell the excess lead rights to refiners with higher than average costs, who could then produce gasoline with lead content above the limit. This production of lead rights was allowed to continue under the interim .50 gplg limit but prohibited when the .10 gplg standard came into effect on January 1, 1986; however, use of existing lead rights is permitted through December 31, 1987.

The cost to industry of the final rule with banking was calculated in the RIA to be lower than the cost of the proposed rule without banking. The Agency determined that per unit costs of complying with the rule would be somewhat higher for smaller refineries, particularly those with less modern equipment.

Decision

As a result of its analysis of the health, economic, energy, and air quality impacts of regulation, EPA promulgated a low-lead standard of 0.10 gplg effective January 1, 1986, while an interim standard of 0.50 gplg went into effect July 1, 1985. The standard of 0.10 gplg was established based on the conclusion that such an amount of lead would be adequate to protect engines at risk from the problem of valveseat recession and that such an effective date would be feasible for the refining industry as a whole. The 0.50 gplg standard was promulgated as it was deemed attainable by the refining industry. Considering these factors, the effective dates of these two standards were also deemed to maximize the net benefits of the standards.

Benefits and costs of the proposed rule, as calculated in the RIA, were considered in setting the two standards: the benefits were shown to substantially exceed the costs, whatever the predicted impact of reduced misfueling.

EPA held a public hearing on the proposed rulemaking and invited written comments before going ahead with promulgation.

Iron and Steel

Regulation

The rule, of May 1982, associated with this RIA defines effluent limitation guidelines for the iron and steel industry. The purpose of this regulation was to specify effluent limitations for “best practicable technology” (BPT), “best available technology” (BAT), “best conventional technology” (BCT), and “new source performance standards” (NSPS) for direct dischargers and to establish pretreatment standards for indirect dischargers.

Monetary benefits were not considered in the final rule.

Regulatory Alternatives

EPA evaluated a number of alternative wastewater treatment technologies to form the basis of the final limitations. The Agency weighed the costs of industrial compliance with each of these alternatives and the derived effluent reduction benefits.

EPA also evaluated alternatives to the concept of uniform national effluent limits based on available technology. These alternatives included allowing waivers from national standards based on economic or local water quality considerations, establishing a single effluent limitation which would apply to a number of discharge pipes within one plant or even to a number of plants (the “bubble” concept), and using receiving water quality standards rather than a technology basis for establishing individual effluent limitations beyond those already in effect. The iron and steel regulation does allow for the bubble concept to be applied across discharge pipes within one facility. Each of the other alternatives could not be legally implemented unless the Clean Water Act is modified. The RIA did not include a discussion of the costs and benefits of the alternatives to uniform effluent limits based on available technology.

Environmental Effects

The end result of the industry’s failure to control pollution was the severely degraded condition of many rivers and streams during the early 1960’s. Federal, State, and local regulatory programs have since caused the cleanup of the most visible problems; however, many streams are still adversely affected by pollutant discharges. The loadings of toxic materials from the iron and steel industry are among the highest of all major industrial categories regulated by the EPA. This regulation was intended to reduce the industry’s toxic pollutant discharges from 19,500 lbs/day to about 10,500 lbs/day with full implementation of BPT and to about 2,300 lbs/day with implementation of BAT. The subsequent improvement in water quality of the stream segments receiving discharges from iron and steel facilities would result in increased recreation opportunities and improved aesthetic conditions.

Benefits

EPA attempted to quantify the benefits of this regulation using two approaches:

1. A specific analysis of the benefits attributable to the regulation for three individual stream segments; and
2. The allocation of shares of the aggregate benefits of water pollution control to the BPT and BAT effluent guidelines for the steel industry.

The benefits of water pollution control are generally classified into four categories:

1. Recreation benefits;
2. Nonuser benefits;
3. Human health benefits; and
4. Diversionary uses and commercial fisheries benefits.

The Agency's case study analysis concentrated on the first two categories because these categories were expected to constitute a significant portion of the total benefits for the stream segments studied.

1. On the Black River in Northern Ohio, the annual benefits were expected to range from \$2.2 - 7.3 million (in 1981 dollars).
2. On the Mahoning River in eastern Ohio and southwestern Pennsylvania, the annualized benefits were expected to range from \$2.3 - 12.1 million.
3. On the lower Monongahela River in southwestern Pennsylvania, the annual benefits were expected to range from \$13.2 - 30.3 million.

To estimate national aggregate benefits of water pollution control, the Agency synthesized a range of aggregate benefit estimates. The Agency pointed out that these estimates were imprecise because, in some cases, the effects of relevant pollutants had been omitted. The estimates also did not account in most cases for the impacts of nonpoint sources of pollution. In contrast to the case studies described above, this aggregate benefits calculation was based on more limited data.

At the time this RIA was written, in March 1982, the iron and steel industry was responsible for 6.5% of all discharges for the pollutant categories for which data were available. Applying this loadings percentage, the total annual benefits of complete abatement of iron and steel effluent, from a 1972 loadings baseline, were calculated to range between \$320 million to \$4.95 billion. The share of this amount due to BPT and BAT loadings reduction relative to discharge levels current at the time this RIA was written ranged from a total of \$35.9 - 727.7 million.

Costs

The following figures are in 1981 dollars.

1. On the Black River, the annualized compliance costs were projected at \$2.7 - 3.2 million.
2. On the Mahoning River, the annualized compliance costs were projected at \$4.2 - 5.5 million.
3. On the Monongahela River, the annualized compliance costs were projected at \$3.7 - 7.1 million.

The estimated annual compliance costs of complete abatement from the 1972 level of the BPT and BAT loadings share of the iron and steel industry discharges ranged from \$46.3 - 48.5 million.

Also, EPA calculated the costs of alternative wastewater treatment technologies for each of the subcategories. As in all other effluent limitations guidelines regulations, this analysis formed an important basis for selecting appropriate control technologies.

Benefit-Cost Analysis

Benefit-cost analysis was not conducted for alternative wastewater treatment technologies; only costs were determined for each subcategory. Benefit-cost analysis was also not conducted for alternatives to uniform national effluent limits based on available technology.

Benefit-cost analysis was done for the proposed standards. The results from the first approach delineated in the benefits section were that, for two of the stream segments (the Mahoning and Black Rivers), the estimated costs were within the range of the estimated benefits but were near the lower end of the range. For the Monongahela River, the estimated costs were less than the lower bound of the estimated benefits range. For all 3 streams combined, the range of estimated annual costs was \$10.8 million to \$15.8 million, while the range of estimated annual benefits was \$17.7 million to \$49.7 million.

The results of the second approach were that the total costs of the iron and steel effluent guidelines regulation were near the lower bound of the range of estimated benefits.

All of the benefits estimates used in this analysis contained a large degree of uncertainty. Nevertheless, the analysis did indicate there was a high probability that the societal benefits of the regulation would significantly outweigh the costs.

Cost effectiveness studies were conducted on various regulatory alternatives on both an intra- and inter-industry basis. Cost effectiveness is defined as the incremental annualized cost associated with a pollution control option in an industry or industry subcategory divided by the incremental "pounds equivalent" of pollutant removed. Within the industry, the results of the analysis showed that, for subcategories where a BAT option other than BPT was selected, the selected option was the most cost-effective one.

A cost effectiveness analysis was done of pollutant removals in the iron and steel industry as compared to other industries: of the seven industries for which BAT limitations had been proposed, the iron and steel regulation was more cost-effective than all except one.

Distributional Effects

Distributional effects of regulation were not discussed in this RIA.

Economic Impact Analysis

Using two scenarios for future demand for domestically produced steel products, EPA estimated that the economic impact of the regulation would be relatively small (under either scenario). The incremental costs resulting from the regulation would result in incremental short-run changes in price, production, market share, and employment totaling about 0.6% or less from their 1985 baseline levels. By the early 1990's, there would be virtually no impact under either scenario, except for a 0.6% increase in price.

Decision

EPA issued, in May 1982, effluent limitations for "best practicable technology," "best available technology," "best conventional technology," and "new source performance standards" for direct discharges and established pretreatment standards for indirect dischargers. EPA invited comments and held meetings with representatives of the industry and other members of the public before promulgating the rule.

EPA promulgated modifications to this rule in May 1984.

Organics and Plastics

Regulation

The Agency proposed effluent limitations guidelines and standards for the organic chemicals, plastic resins and synthetic fibers industries in March of 1983. The proposed regulations included effluent limitations and standards based on Best Practicable Control Technology Currently Available (BPT), Best Available Technology Economically Achievable (BAT), New Source Performance Standards (NSPS), and Pretreatment Standards for New and Existing Sources (PSNS and PSES). The regulations were proposed under authority of the Federal Water Pollution Control Act, as amended by the Clean Water Act of 1977.

Since the proposed rule, substantial new data collection and analyses have been conducted, and new standards are being developed. A separate RIA document is being developed for the final rule. This will include case studies of the benefits of the rule, economic impact studies, and an environmental assessment of the affected industry. Also, currently being developed are: a study of the benefits of the rule for the Delaware River, a national water quality benefits estimate based on the case studies, and a national volatile organic compounds (VOCs) intermedia transfer study.

Regulatory Alternatives

Unlike other industries for which EPA has established effluent guidelines, the OCPSF industry is not amenable to the specification of a single model technology. Instead, effluent limitations will be achieved using some combination of in-plant control, treatment of specific wastestreams by any of a variety of physical/chemical methods, biological treatment of combined wastestreams, and post- biological treatment. The regulatory options examined for the 1985 economic impact study include various combinations of these control technologies.

Environmental Effects

Two studies were done in 1985 assessing the environmental impacts of the organic chemicals, plastics, and synthetic fibers industry (OCPSF). One of these studies covered 81 direct discharging facilities. The other covered 109 indirect discharging facilities. Both used a simplified dilution water quality model to predict the increase in in-stream pollutant concentrations resulting from direct or indirect discharges.

Over 60% of the OCPSF direct dischargers using current pollution control practices were projected to exceed water quality criteria on toxicity levels. This amount was projected to be reduced by as much as 50% by implementing BAT treatment. While 33% of the pollutants identified were projected to exceed water quality criteria under current conditions, this number would be reduced by 66% with BAT treatment.

Over 27% of the indirect dischargers using current pollution control practices were projected to exceed water quality criteria of toxicity levels. This amount was projected to be reduced by as much as 70% by implementing PSES treatment. Over 30% of pollutants were projected to

exceed water quality criteria under current conditions, which number would be reduced by over 80% with PSES treatment.

In preparing its analyses of the organic chemicals effluent guidelines, EPA found that wastewater treatment processes could generate significant emissions of VOCs into the air. As a result of this finding, new regulatory options that would control this intermedia transfer of pollutants are now being considered as part of the rulemaking. The benefits of controlling the intermedia transfer of VOCs into the air are reductions in exposure to carcinogenic and non-carcinogenic compounds that result in adverse health effects and to VOC-generated ozone that results in adverse health and welfare effects.

Controlling effluent discharges from the OCPSF industry would have beneficial effects on human health by reducing the incidences of cancer and other toxic effects of pollutants. It would also reduce the toxic effects of pollutants on aquatic life.

Benefits

To help demonstrate the benefits of regulation on the OCPSF industry, EPA undertook studies of the incremental economic benefits of the regulation on specific stream segments. The stream segments studied in 1983 were (1) the Kanawha River in West Virginia, and (2) the Houston Ship Channel/Upper Galveston Bay, in Texas. Also, currently in process are: a study of the benefits of regulation for the Delaware River; a national water quality benefits estimate based on the case studies; and a national benefits study based on the measurement of VOC intermedia transfer effects.

The approach for measuring benefits used in the 1983 studies involved estimating present and potential future benefits from water quality improvements on the case streams. The benefit categories included recreation benefits, non-user benefits, health benefits, diversionary uses and commercial fishing benefits. The analytic techniques included direct estimation of the change in recreational activity on the case streams. Health benefits were not monetized.

For the Kanawha River the total dollar benefits per year were estimated to be in the range of \$2.3 - 9.7 million. These numbers reflected the benefits of moving from current, in-place treatment to the proposed BAT. The analysis of the Houston Ship Channel was hampered by lack of data on water quality and recreational activity and by the complexity of the task. The estimated benefit was less than \$1 million annually, but more information might indicate a greater level of benefits. All estimates were in 1982 dollars.

Costs

Treatment costs for BPT and BAT/PSES were estimated independently in 1985. The major categories of estimated costs included those for capital equipment, land, operation and maintenance, sludge treatment and disposal, and compliance monitoring. Costs are estimated on a plant-by-plant basis. For the BPT and PSES options, the treatment costs are incremental from the current treatment in-place at the plants. For the BAT options, the costs are incremental to

BPT Option II. Total annualized treatment costs ranged from \$131 million (in 1982 dollars) to \$676.8 million.

Regarding the case studies, the total annual costs calculated for the Kanawha river were \$5.8 million. The total annual costs for the Houston Ship Channel were estimated to be \$25 million.

Benefit-Cost Analysis

For the Kanawha River, the benefits of moving OCPSF facilities from in-place treatment to proposed BAT were found to be roughly comparable to the costs; for the Houston Ship Channel, the costs of further treatment would clearly outweigh the nonhealth-related benefits, but nonmonetized reductions in health risks would be realized with the addition of BPT and BAT pollution abatement controls.

Distributional Effects

Plants in the OCPSF industry are concentrated in the North Central, Mid Atlantic, Southeastern, and Southwestern states.

Economic Impact Analysis

In 1985, EPA identified 997 OCPSF establishments in order to conduct an economic impact analysis of regulation. The primary economic impact variables assessed include the costs of the contemplated regulations, and the potential for these regulations to cause plant closures, price changes, unemployment, reductions in profitability, shifts in the balance of trade and anticompetitive effects on small businesses and new facilities. Across options, the median decrease in profitability ranged from 7.5% to 33.9%. The median production cost increase ranged from 0.5% to 2.4%. The median liquidity reduction ranged from 4.8% to 26.6%. Estimated plant closures ranged from 4 to 20. And plant closures were estimated to result in job losses ranging from 251 to 9,906.

The BPT and PSES regulatory options are not expected to have foreign trade impacts. BAT Option II is expected to have a small impact on one chemical group and BAT Option III is estimated to have a small impact on two chemical groups.

Projected closures are more heavily weighted among small businesses, especially at BPT and PSES.

Decision

EPA proposed effluent limitations guidelines based on the application of the best practicable technology, best conventional technology, best available technology, new source performance standards, and pretreatment standards for existing and new sources. These proposed regulations apply to wastewater discharges resulting from the manufacture of organic chemicals, plastics and synthetic fibers. EPA considered the health and ecological effects, economic benefits and costs,

as well as availability and practicability of technology in setting its effluent standards for the OCPSF industry.

EPA will consider comments received in response to the proposal and to subsequent notices in setting the final rule.

Asbestos

Regulation

Asbestos is a naturally occurring substance applied in a wide variety of industrial uses because of its desirable properties and because it can be produced at prices competitive with those of available substitutes. Unfortunately, exposure to asbestos dust has been shown to increase significantly an individual's risk of contracting a number of potentially serious diseases.

EPA has determined, according to criteria set down by the Toxic Substances Control Act (TSCA) of 1976, that all uses of asbestos should be controlled because asbestos products may pose an unreasonable risk to human health due to the potential for exposure to asbestos throughout the life cycle of the products; that is, the mining, milling, manufacturing, processing, use, and disposal of the asbestos product.

Regulatory Alternatives

This RIA examined 10 regulatory alternatives, which involve either product bans, or fiber phase-down rules, or combinations of both. Fiber buyers or sellers would be issued permits, depending on the specific alternative, that would limit the quantity of fiber sold or bought, and these permits would be transferable. The baseline exposure assumptions ranged across alternatives from 0.5 fiber/ milliter (f/mL), strictly complied with, to 2.0 f/mL, not always complied with. (The exposure assumption of 0.2 f/mL was also studied in the rulemaking process although not included in this RIA.)

Environmental Effects

Reducing asbestos manufacture and use was anticipated to have beneficial effects on human health, resulting in a significant reduction in incidences of lung cancer and mesothelioma.

The Nicholson relative risk model was used in this RIA to estimate the number of lung cancer cases avoided due to regulation, and Nicholson's absolute risk model was used to estimate the number of mesothelioma cases avoided. The estimates were presented using three different baseline exposure assumptions:

1. Actual exposures assuming the 2 f/mL standard is in place, but is not always complied with.
2. Exposures assuming that the 2 f/mL standard is in place and is strictly complied with.
3. Exposures assuming a 0.5 f/mL standard is in place and is strictly complied with.

(Exposures assuming a 0.2 f/mL standard is in place and strictly complied with were also studied in the rulemaking process, but not included in this RIA.)

Total cancer cases avoided, assuming actual compliance with the 2 f/mL standard, ranged across alternatives from 2,306 to 4,545. Assuming strict compliance with the 2f/mL standard, the numbers ranged from 1,632 to 3,441; and assuming strict compliance with the 0.5 f/mL standard, the numbers ranged from 793 to 1,725.

Benefits

Benefits in this RIA were defined as number of cancer cases avoided due to regulation. (See above.)

Costs

Three types of regulation costs were projected:

1. Welfare losses incurred by consumers.
2. Welfare losses incurred by owners of capital equipment used to produce asbestos and asbestos products.
3. Dislocation costs incurred by displaced workers.

Total surplus losses due to regulation ranged across alternatives from \$437 million to \$2,747 million. These costs are for the period from 1985 2000, discounted at a 10% discount rate. Worker dislocation costs from plant closings due to product bans total \$12.9 million. This cost is in 1983 constant dollars and would be incurred in 1985.

Benefit-Cost Analysis

A traditional benefit-cost analysis was not performed for this RIA. Instead, a cost effectiveness analysis was made, which yielded an estimate of the cost per cancer case avoided, and a comparison of this estimate across regulatory alternatives. The estimates are very sensitive to the baseline exposure assumptions made. If the assumption is of actual compliance with the 2.0f/mL standard, the cost per cancer case avoided ranges from \$137,489 to \$607,261; assuming strict compliance with the 2.0f/mL standard, the costs range from \$194, 301 to \$502,092; and assuming strict compliance with the 0.5f/mL standard, the costs range from \$432,277 to \$1,600,000.

Distributional Effects

Under all of the alternatives, the greatest losses would be incurred by domestic secondary processors and other downstream consumers of asbestos products. However these losses would be spread out over many companies and consumers. The highest concentration of secondary processors is in Region V, the Great Lakes area. In contrast, the relatively small losses of domestic miners and millers would be shared by only three companies, located in Vermont and California.

Those who would benefit from the regulation of asbestos are those who may be exposed to asbestos, both in occupational and nonoccupational settings. Occupational exposures occur during the mining and milling of asbestos and in the manufacture, installation, repair, and disposal of the asbestos products or among those using the products at work. Nonoccupational

exposure may occur among persons living or working close to the asbestos product manufacturing site or close to a site where the asbestos product is used or discarded. Nonoccupational exposure also includes consumers of automobiles and housing in every state.

The effects of U.S. regulation of the market will also be felt abroad; as Canada is the most important source and importer of U.S. asbestos, it would be the country most affected by the product bans and fiber cap.

Economic Impact Analysis

Most capital equipment used to produce asbestos products can be converted fairly easily to produce other products often substitutes for the asbestos products.

Projected market adjustments due to the ban (of roofing felt, flooring felt and felt-backed vinyl flooring, V/A floor tile, A/C pipe, and asbestos cloth used to make protective clothing), which is included in all the alternatives except Alternative 10, include a 32.9% reduction in asbestos fiber price and a 48% reduction in equilibrium output of asbestos fiber. Prices of certain unbanned asbestos products would decline by more than 10%, inducing equilibrium demand increases by 25% or more.

All regulatory alternatives except Alternative 1 involved the imposition of an asbestos fiber phase-down rule beginning in 1985, accompanied or unaccompanied by a products ban. Under these conditions, the price was projected to increase for Alternatives 2 and 3 from \$557 per ton in 1985 to \$6,624 per ton in 2000; for Alternatives 4-7, the price would increase from \$557 in 1985 to \$8,684 in 1994; for Alternatives 8 and 9, the price would increase from \$557 in 1985 to \$6,246 in 1989; and for Alternative 10, the price would increase from \$601 in 1985 to \$5,809 in 2000.

Only 27 small primary processors (out of a total of 212 firms) would experience producer surplus losses under the proposed regulation, and their losses would be approximately 10% of total producer surplus losses of domestic companies.

Decision

As a result of its review of the health effects associated with asbestos and the economic consequences of asbestos regulation, EPA is proposing to prohibit the manufacture, importation, and processing of seven asbestos products and to phase out the use of asbestos in all other products by 1995. Eventually, all mining or importation of asbestos would be prohibited, except for that mining or importation allowed under an exemption process.

EPA is requesting comments on an alternative rule, which would ban the manufacture, importation and processing of asbestos at staged intervals. EPA is also requesting comments on the feasibility and effectiveness of labeling all asbestos products that are not banned.

PCB Transformers

Regulation

Section 6(e) of the Toxic Substances Control Act (TSCA) bans the continued use of polychlorinated biphenyls (PCBs), except for certain specifically authorized uses and for totally enclosed uses. EPA issued the Electrical Use Rule in 1982 allowing the continued use of PCBs in most electrical equipment (considered an “enclosed use”) during the remainder of the equipment’s useful life, but requiring quarterly inspections of the transformers, and phasing out the use of certain other transformers. This rule focused on the exposure risk posed by PCBs resulting from leaks or spills of PCB-containing dielectric fluid from electrical equipment. However, as a result of several incidents involving PCB transformers, EPA proposed another rule dealing specifically with PCB transformers located in or near buildings where fires or electrical malfunctions could pose substantial risk to human health or the environment as a result of exposure to PCBs or PCB oxidation products.

Regulatory Alternatives

Regulatory alternatives to the current authorized use of indoor PCB transformers included:

1. Accelerated phase out/replacement of indoor PCB transformers (over 5 years).
2. Accelerated phase out (over 10 years).
3. Retrofill of existing PCB-askarel filled transformers with alternative fluids.
4. Additional electrical protection.

Environmental Effects

Additional control of PCB-containing electrical transformers would substantially reduce the adverse effects to human health and the environment caused by exposure to PCBs following a catastrophic fire or explosion.

Benefits

Two measures of benefits due to regulation were derived in this RIA:

1. The reduction in catastrophic events resulting from PCB transformer fires or failure;
and
2. The dollar savings resulting from avoided clean-up costs.

For purposes of analysis, catastrophic events were assumed to cost \$20 million to clean up. The costs focused on in this analysis were the incremental costs incurred as a result of a fire or a failure being associated with a PCB transformer. Because fire risk is not uniform across transformer types, calculations of both benefits and costs of regulation were made separately for 3 types of transformers. The savings associated with regulation are based on the reduction in incidences of catastrophic events calculated under each alternative. For 480Y/277 Spot Network

transformers, the total number of catastrophic events avoided ranged across alternatives from 21.2 to 29.7, and the total clean-up cost avoided ranged from \$123.2 million to \$234.3 million; for 208Y/120 Grid Network transformers, the number of events avoided ranged from 2.8 to 4.2 and costs avoided ranged from \$16.7 million to \$35.1 million; for 480Y/ 277 Radial Transformers, the number of events avoided ranged from 8.8 to 12.8, and costs avoided ranged from \$53 million to \$106.7 million. All dollar measures reflect 1985 present value using a 10% discount rate.

Costs

The costs of regulation were defined as the incremental costs of implementing a given regulatory option, including direct labor, capital, and registration costs, as well as any changes in transformer operating costs. For 480Y/277 Spot Networks, the total real resource costs ranged across alternatives from \$121.1 million to \$173.3 million; for 208Y/120 Grid Networks, the costs ranged from \$36.8 million to \$286.2 million; for 480Y/277 Radial Transformers, costs ranged from \$554.6 million to \$1,205.2 million. The cost measures reflect present value and use a 10% discount rate.

Benefit-Cost Analysis

In this RIA, the only benefits monetized were the clean up costs avoided. For each alternative the net cost was defined as the incremental cost of regulation minus incremental clean up costs avoided. A ratio of net cost to expected number of events avoided was then calculated, yielding a cost per expected event avoided. Regulation of 480Y/277 Spot Networks produces a net gain to society: that is, the avoided clean-up costs exceed the costs of regulation. Total benefits ranged across alternatives from \$2.1 million to \$41.3 million. For the other source categories the costs of regulation exceeded the clean up costs avoided. For 208Y/120 Grid Networks, total net costs ranged from \$11 million to \$266 million, with associated cost effectiveness ranging from \$3 million to \$74 million per avoided event. For 480Y/277 Radial transformers, total net costs ranged from \$500 million to \$1.098 billion, and cost effectiveness ranged from \$47 million to \$86 million per avoided event.

Distributional Effects

The costs of regulation will be borne by owners of PCB-containing transformers. Of an estimated 104,284 indoor PCB transformers, 17.5% are owned by electric utilities. Owners of the remaining transformers in service at the end of 1984 include public (5%), commercial (52%), and industrial (26%) building owners. However, as a result of variations in transformer characteristics, the distribution of regulatory costs among ownership segments is not proportional to the number of transformers owned. Large commercial building owners and public utilities were expected to bear the highest regulatory costs – \$355.4 million and \$177.1 million, respectively.

Economic Impact Analysis

One major commercial ownership group, real estate development companies, participates in one of the economy's most competitive markets and therefore is not likely to pass on a significant portion of these costs to tenants. Because of the pressure of Public Utility Commissions, public utilities will not be able to pass on regulatory costs either.

In this RIA, measures of economic impact on individual companies were determined. These measures demonstrated that customer and shareholder impacts are likely to be less than 1 percent in all cases, except for small, localized PCB transformer owners. For these owners, impacts could potentially reach several percent, with cash flow impacts likely to be the most significant.

Decision

The Final Rule regarding PCB transformers prohibits the use of 480Y/227 Spot Network transformers in or near commercial buildings after 1 October 1990, requires enhanced electrical protection on 208Y/120 Grid networks and 480Y/227 Radial transformers by 1 October 1990, prohibits the installation of PCB transformers in or near commercial buildings after 1 October 1985, requires the registration of all PCB transformers with fire response personnel and building owners by 1 December 1985, requires the marking of the exterior of all PCB transformer locations by 1 December 1985, and requires the removal of stored combustibles located near PCB transformers by 1 December 1985. The net costs of this rule were estimated to be \$390 million; the average cost effectiveness of the Rule was estimated to be \$11 million per avoided event.

TSCA requires that, in issuing rulemaking under TSCA's authority, EPA must consider health and environmental effects as well as economic consequences. The benefits and costs of the regulatory options discussed in this RIA contributed to the final regulatory decision on PCB transformers.

Premanufacture Review

Regulation

Section 5(a)(1)(A) of the Toxic Substances Control Act (TSCA) requires manufacturers and importers of new substances to provide EPA with notice of their intent to manufacture or import such substances at least 90 days prior to when actual manufacturing or import begins. Although TSCA does not require that premanufacture notice (PMN) requirements and processes be stated in a rule, EPA determined that the issuance of a procedural/interpretive rule and a form was in the best interest of all concerned parties. The form was to be set up to determine whether the commercial introduction of newly developed substances would present an unreasonable risk to human health or the environment.

Regulatory Alternatives

Three alternative forms for the premanufacture notice were considered initially in this analysis. As a result of analysis in support of this study, a fourth form was developed. The four forms were differentiated by the scope of the information requested:

1. EPA 79 form (an interim proposal developed by EPA in 1979) would require submitters to provide the most information. It would require more detailed production and marketing data, explanation of physical and chemical properties and exposure, release, and disposal data, than the other forms would.
2. CMA 79 Form: The Chemical Manufacturers Association developed a proposed PMN form based on the principle that Section 5(d) of TSCA provides an all-inclusive list of the information that a PMN is to contain. This form would make the provision of risk assessment and exposure and release information optional.
3. EPA 82 Form would require the submitter's identity; the chemical name of the substance; its identity and molecular structure; production and marketing data; flow diagram; and worker exposure, release and disposal estimates.
4. Final Form: This form is very similar to the EPA 82 form, except that it adds information about worker activity exposure, general information about sites controlled by others, and clarifies other sections.

Environmental Effects

Use of the different chemical reporting forms would result in a greater or lesser probability of prevention of adverse health and environmental effects resulting from exposure to toxic substances. In a study of five cases of previously reviewed PMNs where use of a different form might have resulted in a different regulatory action, uncertainties concerning dose response relationships made quantitative assessments of risk reduction difficult; and the small number of cases studied is not a statistically valid sample of the potential health benefits of each form. It was assumed that the major health benefits from regulation would occur as the result of regulation acting as a deterrent, that is resulting in the introduction of less hazardous chemicals than would otherwise have been introduced.

Benefits

Benefits were not quantified for this RIA. Benefits of the alternative forms are primarily the health benefits that result from having sufficient information to make correct decisions. The Office of Toxic Substances in EPA conducted a study of PMN cases to determine whether use of any of the three alternatives other than the final would not have identified the PMN substances for Agency action. The results of this study suggest that the EPA 79 form is more likely to provide sufficient information for regulatory decisions in marginal cases than either the EPA 82 or CMA 79 forms. However, the probability of EPA identifying a problem substance is not significantly lower with the forms other than EPA 79; thus the incremental benefits of the lengthier form are small.

Costs

Following are the costs which firms will incur in complying with Section 5 requirements:

1. Direct filing costs.
2. Confidentiality: If the firm claims the data contained in a PMN are confidential, the costs increase.
3. Delay costs: The reduction in the present value of the retrofit stream for the new chemical because of delayed introduction into commerce.
4. Cost of voluntary actions taken by firms during the PMN review to reduce possible health hazards; these actions are taken to forestall EPA from placing restrictions on production of the chemical.

Total industry costs per year in 1981 dollars, assuming 900 new substances per year, ranged across alternatives from \$4.8 - 11.4 million, for the EPA 82 Form, to \$6.9 - 20.6 million, for the EPA 79 Form. (Annual costs for the Final Form were estimated to be \$5.2 - \$13 million.) EPA review costs for all alternatives were \$7.0 million. Total costs for the Final Form were \$12.2 - 20 million.

Benefit-Cost Analysis

A traditional benefit-cost analysis was not performed in this RIA.

Distributional Effects

Distributional effects of regulation were not discussed in this RIA.

Economic Impact Analysis

Based on data from industry commissioned surveys and data in PMN files, it appears that since the PMN program became effective, there has been no significant change in the number of new substances introduced by the largest companies, though there might have been a decline

from small companies. This decline reduces total industry profits from new substances by less than 5 percent.

Regulatory costs to firms with less than \$30 million in annual sales represent less than 1% of sales for these companies and between 0.9 and 2.1% of their profits. For firms under \$100 million in annual sales, costs represent less than 0.1% of sales and 0.3 - 0.6% of profits. The exemption rules are expected to result in a savings of 11 to 35% for small firms.

Decision

In January, 1979, EPA proposed a rule and forms to implement the TSCA Section 5 notice requirements; the rule and forms were re-proposed in part in October 1979, and supplemented by a processor reporting proposal in August 1980 and a clarification of importer reporting requirements in September 1980. In May 1983, EPA issued a final rule and notice form. The notice requirements and procedures established in this rule replaced the Interim Policy under which EPA had been conducting the new chemical notice review program since it began on July 1, 1979.

Although this rule will not have an annual effect on the economy of \$100 million or more, EPA based its classification of the rule as "major" on various studies conducted on the costs of compliance with Section 5 notice requirements and the effect of these requirements on new chemical innovation.

Along with considerations of health effects, EPA considered the economic effects of regulation in promulgating this rule.

Management of Used Oil

Regulation

EPA has tentatively determined that used oil typically and frequently contains significant quantities of lead and other metals, chlorinated solvents, toluene, and naphthalene. Improper management of used oil would pose a substantial hazard to human health and the environment. EPA is proposing to control the management of used oil in order to reduce these risks.

Passage of the Used Oil Recycling Act (UORA), codified as Section 3014 of the Resource Conservation and Recovery Act (RCRA), and Amendments to Section 3014 in the Hazardous and Solid Waste Amendments of 1984 have given EPA the specific mandate to regulate used oil recycling. In setting the regulation, EPA considered its costs as well as its health and welfare effects.

Regulatory Alternatives

In making its decision to propose these rules, EPA evaluated in the RIA four regulatory alternatives.. These alternatives include administrative standards, today's listing and management standards, and upcoming standards on used oil combustion devices.

Alternative 1 is the imposition of full hazardous waste standards as previously promulgated. The remaining three alternatives control the flow of used oil with a limited set of regulations less stringent than those presently applied to hazardous wastes. The alternatives also vary by the limits on lead content set in the fuel specification. In alternatives 1 and 2, the lead standard is established at 100 parts per million (ppm). In the last two alternatives, the lead standard is set at 50 and 10ppm.

Environmental Effects

Used oil contaminants can be transported through the air as well as through surface and ground water. The nature of the effects of used oil contaminants is as broad as the range of types of these contaminants themselves. Many of the organic contaminants are known human carcinogens, as are several of the inorganic contaminants. Other inorganic materials (e.g., lead) are known to cause brain and renal damage, (The RIA quantitatively evaluates only carcinogens.)

Potential exposure estimates were translated in the RIA into cancer risk estimates using traditional linear dose-response functions and then aggregated nationwide.

Benefits

Benefits were not monetized for this RIA; instead, they were represented by reductions in potential cancer risks from exposure to used oil contaminants. The reduction from the baseline that would be achieved by regulation ranged across alternatives from 60 to 67 percent. Neither non-cancer effects nor ecological effects were quantified in the RIA.

Costs

The costs of regulation would include incremental costs for storage controls, administrative requirements, tracking used oil from its point of collection to end use, and testing controls. They would also include costs of controlling the burning and disposal of used oil. These costs were estimated in this RIA for each facility, then aggregated nationwide. Total annual compliance costs ranged from \$167 million for the proposed alternative to \$525 million for the full hazardous waste standards.

Benefit-Cost Analysis

A traditional benefit-cost analysis was not made in this RIA: instead a comparative cost-effectiveness ratio was determined for each alternative, attained by dividing total annual costs by the number of potential cancer cases avoided (adjusted to a per-year basis). Cost-effectiveness ratios ranged from \$1.29 million per potential cancer case avoided to \$4.12 million. (However, since these calculations are based on the use of relative risk reductions rather than absolute risk reductions, these dollar values are likely to be underestimates of the cost-per-cancer-case avoided. As such, this cost-effectiveness measure should be taken only as a basis of comparison among regulations and not as an indication of absolute cost-effectiveness.)

Distributional Effects

Costs of regulation would accrue to the following groups: generators of used oil, collectors and processing facilities, and end-users of used oil, such as asphalt plants and commercial road-oiling services. Small and medium-sized collectors would be likely to suffer the most under regulation.

Economic Impact Analysis

In order to estimate the economic impact of the alternative regulations on industries that buy and sell used oil, EPA developed a financial profile of model facilities based on income statements and projected cash flows, and estimated the value of the facilities after regulatory costs and associated price changes took place. This analysis showed that costs incurred by the proposed regulation would cause facilities to raise the prices at which used oil is purchased and sold, contributing to the closing of approximately 473 of 700 collector facilities. Most of these closures would be small facilities, and many of these would be replaced by expanded large facilities. Re-refiners and fuel processors were expected to profit from regulation and produce larger volumes of recycled used oil products.

Decision

As a result of its review of the health and welfare criteria associated with used oil, as well as of its analysis of the cost-effectiveness of the regulatory alternatives, EPA proposed Alternative 2 in regulating generators and transporters of recycled oil, and owners and operators of used oil recycling facilities. The standards included tracking requirements when used oil is shipped

off-site for recycling, and facility management requirements when used oil is stored prior to recycling. Because the RIA found that the cost of the full hazardous waste standards could lead to increased dumping of used oil by some segments of the regulated community, Alternative 2 included different standards for small, medium, and large generators and reduced standards for some used oil transporters. Recycled oil used as fuel was subject to certain regulations; the lead content in the fuel specification was established at 100 ppm. Disposal of recycled oil was regulated, and road oiling was prohibited outright.

The Administrator invited comments from the public for consideration in promulgating the standards. The concern about increased dumping and reduced recycling, raised in the RIA, was expressed by a great many commenters. Subsequently, EPA announced that it would not list used oil bound for recycling as a hazardous waste and would reconsider its options for regulating used oil bound for disposal.

Land Disposal of Hazardous Wastes

Regulation

The 1984 Amendments to the Resource Conservation and Recovery Act (RCRA) prohibit the land disposal of all listed hazardous wastes by specified dates unless EPA determines through a site-specific petition process that continued land disposal of these wastes is protective of human health and the environment, or unless wastes comply with treatment standards to be established by EPA. EPA has proposed a regulatory framework for specifying treatment standards for land disposed wastes. These standards include screening levels that would result in no significant health hazard to persons exposed to releases of hazardous constituents from land disposal units, and Best Demonstrated Available Technology (BDAT) standards in cases where no technology can achieve the screening level but the BDAT substantially reduces toxicity.

Regulatory Alternatives

Alternative 1 does not provide for the development of a screening level but instead relies entirely on technology-based standards and the petition process.

Under Alternative 2, EPA would take no action to determine if continued land disposal of the affected hazardous waste is protective of human health and the environment. As a result, land disposal of these hazardous wastes would be banned after a certain date, under the RCRA Amendments' hammer provisions.

Under Alternative 3, the Agency would not ban land disposal of the affected hazardous wastes. Instead, EPA would require (1) treatment of contaminated drinking water prior to use, or (2) corrective action to clean up a contaminated aquifer.

In this RIA, only the Agency's proposed regulatory framework was analyzed.

Environmental Effects

Controlling land disposal of toxic materials will have beneficial effects both on human health and the physical environment.

Benefits

In this RIA, benefits were expressed in terms of number of health risk reductions and percentage reduction from current risks achieved by land disposal restrictions. This analysis derived human health risk distributions for each combination of waste and type of treatment technology. The percentage reduction from current risks attained by the proposed regulation was estimated to be approximately 60%.

Costs

To calculate the incremental costs incurred by society as a result of the proposed land disposal restrictions, this RIA first estimated the current costs of land disposing hazardous

wastes, then identified the minimum cost treatment alternative to land disposal. The difference between the costs of baseline land disposal and the minimum cost treatment alternative, summed across the estimated number of facilities nationally, represents the social cost of the regulation. Total social costs of restricting all hazardous wastes from land disposal were predicted to be approximately \$1.3 billion per year, including wastes managed at commercial facilities, noncommercial facilities, and small quantity generators.

Benefit-Cost Analysis

Benefits and costs were not compared in this RIA.

Distributional Effects

Distributional effects of regulation were not discussed in this RIA.

Economic Impact Analysis

In the economic impact analysis, the increased costs of complying with the proposed regulation were compared to the overall cash flow and production costs of firms in the affected industries to determine the implications of the regulation for the economic sectors generating and disposing of hazardous wastes.

All of the significantly impacted non-commercial facilities (175) would experience potential reductions in cash from operations (CFO) of greater than 5%. Seventy-one of these facilities would also experience potential increases of greater than 5% in cost of production (COP). The remaining significantly affected facilities, and all of the 238 less severely impacted facilities, could pass on to their customers the full cost of regulatory compliance via a product price increase of less than 5%.

Commercial facilities were divided into two types, one which primarily land disposes wastes while the other provides a range of treatment and disposal alternatives. Among the facilities that provide solely land disposal services, 7 facilities would incur significant revenue loss (a total ranging from \$144,000 to \$29 million) if RCRA waste handling was shifted to the more technologically diverse firms. These land disposal firms would have to enter a different market, one in which they may have limited competitive advantage. The other land disposal oriented firms rely upon RCRA waste handling for 9% or less of their revenue. Technologically diverse firms, on the other hand, would benefit from both the elimination of low-priced competitive treatment and disposal practices and the probable increase in quantity of waste shipped to them.

The economic impact of RCRA waste land disposal restriction on small quantity generators was not significant.

Eighty-four of the 175 significantly impacted noncommercial facilities were small businesses. The sections most affected would be Primary Metals (with 30% increase in COP and 823% reduction in CFO), Lumber and Wood Products (total compliance costs of \$303,988), and Petroleum Refining.

Decision

January 1986's rule restricting land disposal of hazardous wastes proposes procedures to establish treatment standards for hazardous wastes, to grant nationwide variances from statutory effective dates, to grant extensions on effective dates on a case-by-case basis, and procedures by which EPA will evaluate petitions demonstrating that continued land disposal is protective of human health and the environment. In addition, this rule prohibits land disposal of certain dioxin- or solvent-containing wastes unless the treatment standards are achieved. This rule was based on considerations of health effects and economic impacts of regulation, and partially on BDAT.

EPA has determined that the regulation of land disposal of solvents and dioxins will not constitute a major rule as defined by Executive Order 12291. However, this and other RIAs were prepared in support of this proposal, in recognition of the scope of the regulatory framework of which restrictions on land disposal of solvent and dioxin wastes are only a part, and of total costs of applying this regulatory framework to all land disposed wastes regulated under RCRA, which will exceed the \$100 million that defines a major rule.

In the Federal Register notice of the proposal, EPA invited comments from the public for consideration in promulgating the standards.

National Oil and Hazardous Substances Pollution Contingency Plan

Regulation

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), enacted in 1980, provides the authority and funding for the President to take removal and remedial actions when hazardous substances have been released or there is a substantial threat of their release into the environment. Section 105 of CERCLA requires revision of the mechanism established in 1973 under the authority of the Clean Water Act (CWA) for coordinating response to specified environmental emergencies, the National Contingency Plan (NCP), to reflect the new authorities of CERCLA. CERCLA provides that actions taken in response to releases of hazardous substances shall, to the extent practicable, be in accordance with the revised NCP. CERCLA requires that the Plan define methods for investigating facilities, methods for remedying releases, appropriate roles for government and industry, provisions for procurement of response equipment, methods for determining cost-effective remedial actions, methods for setting up national priorities among sites, and other factors.

In developing these revisions, considerations of costs as well as engineering feasibility, environmental, welfare and public health effectiveness were made in choosing among alternative regulatory options; however, monetized benefits were not considered.

Regulatory Alternatives

Two regulatory alternatives were evaluated. Each alternative reflected a different formulation of the goals and scope of the NCP revisions and a substantially different method of allocating the Superfund:

1. Alternative 1 characterizes the objectives of the NCP revisions as the protection of public health, welfare, and the environment, with the emphasis on public health concerns.
2. Alternative 2 gives greater emphasis to public welfare and the environment, thereby increasing the likely costs of response at each individual site.

EPA proposed Alternative 1 as the preferred option.

Environmental Effects

Anticipated health benefits from regulating the disposal of hazardous substances included health benefits from:

1. Stemming the contamination of groundwater sources supplying water for human consumption (the analysis showed that Alternative 1 would reduce the population at risk of exposure to contaminated groundwater by about 4.9 million, compared to 4.4 million under Alternative 2);
2. Stemming the spread of hazardous chemicals through the air due to corrosion or rupture of contaminant vessels, fire or violent chemical reactions; and

3. Reducing the risk to populations due to soil and surface water contamination.

All of the above imply environmental benefits, which were not quantified in this RIA.

Benefits

No monetized benefits were calculated for this RIA.

Costs

Under the two regulatory alternatives, there are no expected differences in the number and cost of removal actions, but there are differences in the projected number of remedial actions, which form the core of the Superfund site cleanup program. And the most important difference between the two alternatives is the estimated cost of a remedial action under each alternative.

In the narrower, preferred option, 170 remedial actions were planned, at an average cost over a seven-year period (1981-87), of \$4.5 million per remedial action, with a total cost of \$765 million. In Alternative 2, the costs per remedial action were increased by 50% to an average cost of \$6.75 million with 115 of these more extensive remedial actions, yielding a total cost of \$776 million.

Benefit-Cost Analysis

No benefit-cost analysis was performed in this RIA.

Distributional Effects

As a result of the regulation, industry will incur costs:

1. As a result of EPA enforcement actions;
2. When costs are recovered from industry after federal response action has been performed; and
3. As a result of privately financed responses induced by provisions of the NCP.

Disposers and chemical producers are likely to bear the largest portion of costs of removals and remedial actions. The cost burden does not fall on these industries as a whole, however, but on individual firms as a result of specific enforcement and cost recovery actions.

Benefits affect those private contractors hired in connection with removal and remedial actions, mainly construction firms. As the risk of exposure to hazardous substances is reduced, public welfare benefits increase. For example, property prices may recover from depression due to proximity to a site, public parks nearby would become accessible again. Communities may revive, benefitting the local tax base.

States and localities affected by the action will accrue both costs and benefits as a result of it. The NCP revisions will establish a list of at least 400 priority sites for remedial action; CERCLA stipulates that the one hundred top priority sites include at least one site from each state “to the extent practicable.”

Economic Impact Analysis

Costs of remedial actions are balanced by pecuniary benefits to firms, mainly construction firms, that are contracted during a hazardous waste cleanup and a societal redistribution of resources.

The additional costs to generators, disposers, and transporters of hazardous wastes will increase their production costs, resulting initially in a combination of output declines and price increases. It is unclear what will be the magnitude of these effects or whether they will persist. The real resource costs (as these costs are called) of the revised NCP were found to be small: upper bound estimates of the decline in output by the chemical industry would be around 0.1%, and of an increase in prices would be about 0.2%.

Although the analysis indicated that an effect could be felt by some individual firms and states, the total impact of the revised NCP would be negligible. Even if all costs attributed directly and indirectly to the revised NCP are passed through to consumers (which is unlikely), the estimated increase in the consumer price index will be less than 0.02%. Output and employment effects are small and are not expected to persist in the long run.

A small initial price increase in the hazardous waste cleanup industry will not have economy-wide effects; the greatest impact of a more significant price increase would be that there could be less cleanup because the cost of cleanup would be higher.

For some states, the potential costs are high because of the extent of their hazardous waste problem. The costs borne by a state for a cleanup where federal funds are used for remedial actions is 10% of costs for privately owned sites and at least 50% of costs for sites owned by state or local governments. Other costs would include institutional and administrative costs associated with establishing a framework in the states for operating under CERCLA, operation and maintenance costs after the Superfund tax expired in 1985, and the possible effect of adverse publicity on reducing state tax bases and increasing unemployment.

Regarding small business entities, it is unlikely that a high percentage of these firms are at risk from potential enforcement actions because they tend to produce much smaller quantities of waste than large firms. Also, EPA is allowed discretion whether or not to proceed with enforcement actions against small businesses.

Decision

Pursuant to Section 105 of CERCLA and Executive Order 12316, EPA promulgated revisions to the National Contingency Plan for oil and hazardous substances. The revised NCP is applicable to response actions taken pursuant to CERCLA and Section 311 of the Clean Water Act.

The Agency invited public comments and incorporated suggested changes in the proposed revisions where appropriate.

Data Requirements for Pesticide Registration

Regulation

EPA, through its Office of Pesticide Programs (OPP), is charged with the responsibility for regulating pesticide use in the United States. The legal authority for regulating pesticides is established by the Federal Insecticide, Fungicide, and Rodenticide Act, as Amended (FIFRA). The Act requires all pesticides to be registered with EPA and further requires EPA to make a finding that if a pesticide is registered, its use in accordance with widespread and commonly recognized practices will not generally cause unreasonable adverse effects on the environment. Section 3(c)(2) of FIFRA requires that EPA publish guidelines specifying the kinds of information required to support the registration of a pesticide.

The benefits and costs of alternative regulations were included among the considerations made in setting the final standard.

Regulatory Alternatives

The Agency considered five alternatives to information generation that supports registration:

1. Reference guidelines: Rulemaking on data submittal requirements would not be issued.
2. Regulation Requirements: The Agency would issue regulations on data submittal requirements for the different types of pesticide products and uses to be registered. Waivers would be permitted and tiered testing approaches specified where appropriate.
3. Self-Certification: Applicants would certify their products would not cause unreasonable adverse effects.
4. Comprehensive Data Requirements: The Agency would issue regulations specifying a list of all data requirements that products must fulfill to obtain registration. Waivers and tiered testing are not considered in this approach.
5. Provisional Registration: Registrants would be allowed to market their products on a limited basis after having submitted results from “indicator studies,” which are short-term and relatively low-cost. Full marketing rights would be granted only after all studies, including chronic effects tests, are submitted.

EPA decided to propose Alternative 2.

Environmental Effects

Pesticides by design are toxic to living organisms. Nontarget species including humans may suffer acute toxic effects from exposure to pesticides.

Pesticides may also produce general types of chronic health effects, although data are limited with regard to the actual extent of pesticide-induced carcinogenicity, teratogenicity, reproductive effects, and mutagenicity. The pesticide registration alternatives will have an effect in detecting

and avoiding these health effects, ranging from comprehensive requirements, being most effective, to self-certification, being one-fifth as effective.

Ecological effects of pesticides are reduced by the current program, and could be reduced further under Alternatives 2 and 4. Major problems would be likely under Alternative 3.

Benefits

Benefits were not monetized for this RIA. Relatively few factors in this analysis were capable of being quantified or monetized. In order to bring the results of the analysis into “net benefit terms,” a “benefit rating technique” was developed, taking into account the relative importance of various factors or criteria to the management of the program and developing relative ratings of the benefits of the alternative rulings. Benefit factors included pesticide program benefits, health effects, and environmental effects. The benefit ratings ranged from a low of 10 for the self-certification alternative to a high of 25 for comprehensive requirements.

Costs

Costs of the alternative regulatory options were composed mainly of industry compliance costs and agency program costs. The calculation of direct compliance involved mainly estimation of unit costs of individual studies and estimation of the number of studies expected to be required on an annual or other time-period basis. Total (direct and indirect) compliance costs ranged from \$103 million/yr. (in 1980/81 prices) to \$141 million/yr. Program costs ranged from \$58 million/yr. to \$65.5 million/yr.

Benefit-Cost Analysis

No traditional benefit-cost analysis was calculated in this RIA. Instead, costs were rated as well as benefits, and a benefit/ cost rating ratio was calculated for each alternative. This ratio ranged from a low of .64 for self-certification to a high of 1.21 for the regulatory requirements alternative.

Distributional Effects

Distributional effects of regulation were not discussed in this RIA.

Economic Impact Analysis

Whereas a substantial portion of increased pesticide costs would be passed on to final consumers in the agricultural sector, in the non-agricultural sector, most of the increased costs would be absorbed either by the pesticide manufacturers or the users of pesticides in the production of other goods and services for sale to final consumers. In either case, net economic impacts would be quite nominal in relation to the size of these sectors.

None of the alternatives would be capable of generating significant economic impacts on macroeconomic variables such as employment, inflation or balance of payments.

The Agency's proposal to implement the regulatory requirements option rather than to maintain the current program would not produce a significant economic impact on a substantial number of small entities.

Decision

As a result of its review of the health and ecological benefits associated with data requirements for pesticide registration, as well as of a consideration of program and compliance costs of regulatory action, EPA chose to promulgate the regulatory requirements option (Alternative 2). Waivers would be permitted under this alternative and tiered testing approaches specified where appropriate.

EPA requested and considered public comments on the proposed rule and revised the rule accordingly.