Chapter 1

Introduction

The *Guidelines for Preparing Economic Analyses* are part of a continuing effort by U.S. Environmental Protection Agency (EPA) to develop improved guidance on the preparation and use of sound science in support of the decision-making process. This document builds on previous work first issued in December of 1983 as the *Guidelines for Performing Regulatory Impact Analysis* (U.S. EPA 1983) and later revised in the late 1990s. In September of 2000, the EPA issued its *Guidelines for Preparing Economic Analyses* (*Guidelines*) (U.S. EPA 2000b), revised to reflect the evolution of environmental policy making and economic analysis that had accrued over the decade and a half since the original guidelines were released. At the time of release, EPA committed to periodically revise the *Guidelines* to account for further growth and development of economic tools and practices.

In an effort to fulfill that commitment, this document incorporates new literature published since the last revision of the *Guidelines*. It describes new Executive Orders (EOs) and recent guidance documents that impose new requirements on analysts, and fills information gaps by providing more expansive information on selected topics. Furthermore, a loose-leaf format has been adopted to facilitate the incorporation of new information in the future. This new, more flexible format, in addition to the electronic release of the document, will allow future updates and additions without requiring a wholesale revision of the document.

1.1 Background

While economic analysis can provide valuable insights into the setting of Agency priorities and plans for meeting them, the focus of this document is on the conduct of economic analysis to support policy decisions and meeting the requirements described by related statutes, EOs, and recommendations in guidance materials. With a few exceptions, the collection of EOs and statutes that govern the conduct of economic analysis and distributional analysis has remained largely unchanged since 2000. EO 12866, directing federal agencies to perform a benefit-cost analysis (BCA) for economically significant rules (those with an economic impact of $100 million or more), still provides the primary impetus for much of the formal BCA within the Agency.[1] However, new guidance documents and handbooks on how to comply with a number of EOs and statutes have been issued both within and outside the Agency in the last several years. The Office of Management and Budget (OMB), for instance, released its *Circular A-4* in 2003 to replace both its "Best Practices" document (OMB 1996) and its "OMB Guidelines" (OMB 2000). *Circular A-4* provides recommendations to federal agencies on the development of economic analyses supporting regulatory actions. As such, it greatly influences the conduct of economic analysis and the development of new analytic tools and approaches within the Agency. The OMB recommendations, as well as other

1 EO 13422, a 2007 amendment to EO 12866, contributed to the formal benefit-cost framework by requiring agencies to "identify in writing the specific market failure (such as externalities, market power, lack of information) or other specific problem that [the regulation] intends to address … as well as assess the significance of that problem." However, EO 13422 was revoked in January 2009 through EO 13497.

guidance documents, are referenced in the revised *Guidelines* where appropriate.

As a result of these modifications and updates the new, revised *Guidelines* will ensure that EPA's economic analyses are prepared to inform the policy-making processes and satisfy OMB's requirements for regulatory review. The new *Guidelines* also seeks to establish an interactive policy development process between analysts and decision makers through an expanded set of cost, benefit, economic impacts, and equity effects assessments; an up-to-date encapsulation of environmental economics theory and practice; and an enhanced emphasis on practical applications.

Underlying these efforts is the recognition that a thorough and careful economic analysis is an important component in informing sound environmental policies. Preparing high-quality economic analysis can greatly enhance the effectiveness of environmental policy decisions by providing policy makers with the ability to systematically assess the consequences of various actions. An economic analysis can describe the implications of policy alternatives not just in terms of economic efficiency, but also in terms of the magnitude and distribution of an array of impacts. Economic analysis also serves as a mechanism for organizing information carefully. Thus, even when data are insufficient to support particular types of economic analysis, the conceptual scoping exercise can provide useful insights.

It is important to note that economic analysis is but one component in the decision-making process and under some statutes it cannot be used in setting standards. Other factors that may influence decision makers include enforceability, technical feasibility, affordability, political concerns, and ethics, to name but a few. Nevertheless, economic analysis provides a means to organize information and to comprehensively assess alternative actions and their consequences. Provided early in the regulatory design phase, economic analysis can help guide the selection of options. Ultimately, good economic analysis based on sound science should lead to better, more defensible rules.

1.2 The Scope of the *Guidelines*

The scope of the *Guidelines* is on economic analysis typically conducted for environmental policies using regulatory or non-regulatory management strategies. Separate guidance documents exist for related analyses, some of which are inputs to economic assessments. No attempt is made here to summarize these other guidance materials. Instead, their existence and content are noted in the appropriate sections.

As with the 2000 *Guidelines,* the presentation of economic concepts and applications in this document assumes the reader has some background in microeconomics as applied to environmental and natural resource policies. To fully understand and apply the approaches and recommendations presented in the *Guidelines,* readers should be familiar with basic applied microeconomic analysis, the concepts and measurement of consumer and producer surplus, and the economic foundations of benefit-cost evaluation. Appendix A provides the reader with a brief review of economic foundations and the Glossary defines selected key terms.

These *Guidelines* are designed to provide assistance to analysts in the economic analysis of environmental policies, but they do not provide a rigid blueprint or a "cookbook" for all policy assessments. The most productive and illuminating approaches for particular situations will depend on a variety of case-specific factors and will require professional judgment. The *Guidelines* should be viewed as a summary of analytical methodologies, empirical techniques, and data sources that can assist in performing economic analysis of environmental policies. When drawing upon these various resources, there is no substitute for reviewing the original source materials.

In all cases, the *Guidelines* recommends adhering to the following general principles as stated by OMB (1996):

> '"Analysis of the risks, benefits, and costs associated with regulation must be guided by the principles of full disclosure and

> transparency. Data, models, inferences, and assumptions should be identified and evaluated explicitly, together with adequate justifications of choices made, and assessments of the effects of these choices on the analysis. The existence of plausible alternative models or assumptions, and their implications, should be identified. In the absence of adequate valid data, properly identified assumptions are necessary for conducting an assessment."
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> "Analysis of the risks, benefits, and costs associated with regulation inevitably also involves uncertainties and requires informed professional judgments. There should be balance between thoroughness of analysis and practical limits to the agency's capacity to carry out analysis. The amount of analysis (whether scientific, statistical, or economic) that a particular issue requires depends on the need for more thorough analysis because of the importance and complexity of the issue, the need for expedition, the nature of the statutory language and the extent of statutory discretion, and the sensitivity of net benefits to the choice of regulatory alternatives."'

Economic analyses should always strive to be transparent by acknowledging and characterizing important uncertainties that arise. In addition, economic analyses should clearly state the judgments and decisions associated with these uncertainties and should identify the implications of these choices. When assumptions are necessary in order to carry out the analysis, the reasons for those assumptions must be stated explicitly and clearly. Analysts must take care to avoid double counting of benefits and costs when there are overlapping regulatory initiatives. Further, economic analyses of environmental policies should be flexible enough to be tailored to the specific circumstances of a particular policy, and to incorporate new information and advances in the theory and practice of environmental policy analysis.

1.3 Economic Framework and Definition of Terms

The conceptually appropriate framework for assessing all the impacts of an environmental regulation is an economic model of general equilibrium. The starting point of such a model is to define the allocation of resources and interrelationships for an entire economy with all its diverse components (households, firms, government).

One of the first methodological questions an analyst must answer when conducting economic analysis is: who has "standing?" The most inclusive answer allows *all* persons who may be affected by the policy to have standing, regardless of where (or when) they live. For domestic policy making, however, the norm is to limit standing to the national level. This decision is based on the fact that authority to regulate only extends to a nation's own residents who have consented to adhere to the same set of rules and values for collective decision making, as well as the assumption that most domestic policies will have negligible effects on other countries (Kopp et al. 1997, Whittington et al. 1986).

OMB's *Circular A-4* gives the following guidance to agencies with regard to conducting economic analyses in support of rulemakings: "Analysis should focus on benefits and costs that accrue to citizens and residents of the United States. Where you choose to evaluate a regulation that is likely to have effects beyond the borders of the United States, these effects should be reported separately" (OMB 2003, p. 15). Potential regulatory alternatives are then modeled as economic changes that move the economy from a state of equilibrium absent the regulation (the baseline) to a new state of equilibrium with the regulation in effect. The differences between the old and new states are measured as changes in prices, quantities produced and consumed, income and other economic quantities. These measurements can be used to characterize the net welfare changes for each affected group identified in the model. Analysts can rely on different outputs and conclusions from the general equilibrium framework to assess issues of both

efficiency and *distribution*. These issues often take the form of three distinct questions:

1. Is it theoretically possible for the "gainers" from the policy to fully compensate the "losers" and still remain better off?
2. Who are the gainers and losers from the policy and associated economic changes?
3. How did a particular group, especially a group considered to be disadvantaged, fare as a result of the policy change?

The first question is directed at the measurement of efficiency, and is based on the *Potential Pareto criterion*. This criterion is the foundation of BCA, requiring that a policy's net benefits to society be positive. Measuring net benefits by summing all of the welfare changes for all affected groups provides an answer to this question. Net benefits are derived by summing all of the benefits that accrue as a result of a policy change (including spillover effects) less costs imposed by the policy on society (including externalities). Since spillovers and externalities by definition are not captured in market transactions, counting private costs and private benefits accruing to market participants is not sufficient for estimating social benefits and costs. The policy that maximizes net benefits is considered the most efficient.[2]

The last two questions are related to the distributional consequences of the policy. Because a general equilibrium framework provides for the ability to estimate welfare changes for particular groups, these questions can be pursued using the same approach taken to answer the efficiency question, provided that the general equilibrium model is developed at an appropriate level of disaggregation.

Although a general equilibrium framework can, in principle, provide the information needed to address all three questions, in practice analysts have limited access to the tools and resources needed to adopt a general equilibrium approach.[3] More often, EPA must resort to assembling a set of different models to address issues of efficiency and distribution separately. However, the limitations on employing general equilibrium models have greatly diminished in recent years with advances in the theory, tools and data needed to use the approach. Chapter 8 contains additional information on general equilibrium models. Analysts should weigh the need for additional precision against the cost of employing general equilibrium models over other methods. In doing so analysts should consider the size, impact, and complexity of the question at hand. In general, the more detailed methods are justified by questions with larger and more complex impacts. This question is considered in each of the chapters on specific models.

The *Guidelines* follows more traditional practices and adopts conventional labels to distinguish models or approaches used to answer questions on the efficiency and distribution of environmental regulations. For purposes of this document, the presentation separates the concepts and approaches into the following three general categories:

- the examination of net social benefits using a *benefit-cost analysis* (BCA);
- the examination of impacts on industry, governments, and non-profit organizations using an *economic impacts analysis* (EIA); and
- the examination of effects on various sub-populations, particularly low-income, minority, and children, using *distributional analyses*.

This division is necessary not only because of data and resource limitations, but because analysts often lack models that are sufficiently comprehensive to address all of these dimensions concurrently. Within a BCA, for example, EPA is generally unable to measure benefits with the same models

2 Appendix A gives a conceptual overview of this discussion. See in particular Section A.3 on BCA.

3 The general equilibrium framework will at least capture all "market" benefits and costs, but may not include non-market benefits, such as those associated with existence value. In practice, models of general equilibrium may be unable to analyze relatively small sectors of the economy. For more on general equilibrium analysis see Chapter 8, Section 4.6.

used for estimating costs, necessitating separate treatment of costs and benefits. Further, when estimating social costs there are cases in which some direct expenditures can be identified, but data and models are unavailable to track the "ripple" effects of these expenditures through the economy. For most practical applications, therefore, a complete economic analysis is comprised of a BCA, an EIA, *and* an equity assessment.

BCA evaluates the favorable effects of policy actions and the associated opportunity costs of those actions. The favorable effects are defined as benefits. Opportunities foregone define economic costs. While conceptually symmetric, benefits and costs are often evaluated separately for "traditional" environmental problems (e.g., emissions of pollutants from point sources into air and water) due to practical considerations. Analysts may organize the analysis of benefits differently from the analysis of costs, but they should be aware of the conceptual relationship between the two. Assessing the effects of environmental policy is inherently a complex process in which results from various disciplines are integrated to predict environmental outcomes and their economic consequences. As EPA addresses increasingly complex environmental problems (e.g., climate change), so in turn will be the models needed to track the various processes to describe and capture policy effects. Computable general equilibrium (CGE) models for these types of policies will become increasingly important.

Once the change in pollution levels resulting from a policy is predicted, this change is translated into health outcomes or other outcomes of interest using information provided by risk assessors. Benefits analyses then apply a variety of economic methodologies to estimate the value of these anticipated health improvements and other sources of environmental benefits. Social cost analyses attempt to estimate the total welfare costs, net of any transfers, imposed by environmental policies. In most instances, these costs are measured by higher costs of consumption goods for consumers and lower earnings for producers and other factors of production. Some of the findings of a social cost analysis are inputs for benefits analyses, such as predicted changes in the outputs of goods associated with a pollution problem. More information on analyzing benefits can be found in Chapter 7 while details on estimating social costs can be found in Chapter 8.

The assumptions and modeling framework developed for the BCA can describe gains and losses to assess efficiency. However the BCA framework often limits detailed examination of the gainers and losers and the impacts on disadvantaged sub-populations. To estimate these two categories of impacts analysts rely upon EIA and equity assessments, which use a multiplicity of estimation techniques. Chapters 9 and 10 provide information on how these analyses relate to BCA and detail estimation techniques.

Note that none of these three types of analyses (BCA, EIA, and equity assessment) address the cost-effectiveness of a policy option. Cost-effectiveness analyses (CEA) report the estimated costs needed to achieve a specific goal or an additional unit of environmental improvement. Costs-per-life-saved and costs-per-ton-of-pollution-reduction are examples of cost-effectiveness measures. When comparisons are made across policies, CEA can be used to help identify the least costly approach to achieving a specific goal.[4]

1.4 Organization of the *Guidelines*

The remainder of this document is organized into ten main chapters as follows:

- Chapter 2: **Statutory and Executive Order Requirements for Conducting Economic Analyses** reviews the major statutes and other directives mandating certain economic assessments of the consequences of policy actions;

4 Note that CEA is not covered extensively in this document. Additional sources for details on CEA include IOM (2006) and Boardman et al. (2006).

- Chapter 3: **Statement of Need for the Proposal** provides guidance on procedures and analyses for clearly identifying the environmental problem to be addressed, and for justifying federal intervention to correct the problem;
- Chapter 4: **Regulatory and Non-Regulatory Approaches to Consider** discusses the variety of regulatory and non-regulatory approaches analysts and policy makers ought to consider in developing strategies for environmental improvement;
- Chapter 5: **Baselines** provides a definition of baseline and discusses how analysts should approach conducting a baseline analysis;
- Chapter 6: **Analysis of Social Discounting** presents a review of discounting procedures and provides guidance on social discounting in conventional contexts and over very long time horizons;
- Chapter 7: **Analyzing Benefits** provides guidance for assessing the benefits of environmental policies including various techniques of valuing risk-reduction and other benefits;
- Chapter 8: **Analyzing Costs** presents the basic theoretical approach for assessing the costs of environmental policies and describes how this can be applied in practice;
- Chapter 9: **Economic Impact Analyses and Equity Assessment** provides guidance for performing a variety of different assessments of the economic impacts of environmental policies;
- Chapter 10: **Environmental Justice, Children and Other Distributional Considerations** (under development) discusses key analytical issues and considerations to keep in mind when performing distributional analyses; and
- Chapter 11: **Presentation of Analysis and Results** concludes the main body of the *Guidelines* with suggestions for presenting the quantified and unquantified results of the various economic analyses to policy makers.