

## **“Guidelines to Standardize Measures of Costs and Benefits and the Format of Accounting Statements”**

### **Introduction**

These Guidelines are designed to help you, our regulatory agencies, do your job more effectively. They also will help us standardize the way we measure the benefits and costs of federal regulatory actions.

### **Why do we need to do Economic Analysis?**

An economic analysis helps you evaluate the consequences of regulatory action. It provides a formal way of organizing the evidence on the key effects -- good and bad -- of the various alternatives you are considering in developing the regulation. This allows you to assess whether the benefits of an action are likely to outweigh the costs. Your evaluation of the consequences of alternative regulatory and non-regulatory actions helps direct resources -- those of society as a whole as well as for your agency -- toward the greatest social good.

Your economic analysis also informs others -- other parts of the Executive Branch of the Federal government, Congress, regulated entities and the public -- of the effects of your action (and assures them of its reasonableness). In order to accomplish this, you should present a “transparent” analysis. This includes:

- Identifying and evaluating reasonable alternatives to the proposed regulatory action,
- Stating the important assumptions and showing the sensitivity of the estimates to these assumptions.

### **What are the major parts of an Economic Analysis?**

Your analysis should contain three basic elements:

- (1) a statement of the need for the proposed action,
- (2) an examination of alternative approaches, and
- (3) an analysis of the benefits and costs of identified alternatives.

In preparing a benefit and cost analysis, you should

- identify a baseline. A benefit and cost analysis is an incremental analysis that compares a regulatory action with a baseline. Agencies often use the alternative of “no action” as their baseline. The selected baseline should represent your best assessment of the way the world would look absent the proposed rule.
- identify and evaluate the linkage between the direct action required (for example, the use of additional safety equipment on the job) and the desirable effects or benefits of the action (for example, a reduction in the risk of injury) for each of the identified alternatives.
- identify and evaluate the undesirable effects or costs of the action for each of the identified alternatives.

Finally, your economic analysis should present a summary of the benefit and cost estimates for each alternative and provide a clear statement of the effects in a form that is easily usable by other readers of the rule.

You will find that you cannot write a good regulatory analysis according to a formula. The preparation of high-quality analysis requires competent professional judgment. Different regulations may call for different emphases in the analyses, depending on the importance and complexity of the regulatory issues and the sensitivity of the benefit and cost estimates to key assumptions.

### **Why are we issuing these Guidelines?**

Section 638(c) of the 1999 Omnibus Consolidated and Emergency Supplemental Appropriations Act and Section 628(c) of the Fiscal Year 2000 Treasury and General Government Appropriations Act requires OMB to issue guidelines to help agencies estimate the benefits and costs of Federal regulations and paperwork and summarize the results of the associated analysis.

These Guidelines draw from the “Best Practices” document developed in 1994 and 1995 by an interagency group co-chaired by the Department of Transportation and the Council of Economic Advisers. That “Best Practices” document in turn revised the “Regulatory Impact Analysis Guidance” published by OMB in 1990 after a two-year notice and comment period. You should use this document in estimating and presenting the benefits and costs of regulations. While it does not represent OMB guidance, you may use the Best Practices document as supplementary material to illustrate further specific issues or techniques. Section I provides guidelines for your preparation of the estimates and the associated agency report. Wherever possible, we use examples from recent regulatory analyses to illustrate important concepts. Section II sets out instructions and a suggested format for the accounting statement.

## SECTION I: GUIDELINES FOR THE ANALYSIS OF BENEFITS AND COSTS OF MAJOR FINAL RULES

### A. GENERAL CONSIDERATIONS

**1. Is There a Need for the Regulatory Action?** President Clinton’s Executive Order 12866 states that “Each agency shall identify the problem that it intends to address (including, where applicable, the failures of private markets or public institutions that warrant new agency action) as well as assess the significance of that problem.” To establish a need for the proposed action, you should explain whether the problem arises because of a significant market failure or some other compelling public need. If there is a significant market failure, you should describe the nature of this failure in both qualitative and quantitative terms. Since the existence of a market failure is not sufficient to justify government intervention, you should show that government intervention to correct the market failure is likely to do more economic good than harm. If the problem is not a significant market failure, you should provide an alternative demonstration of compelling public need. Such needs may include the improvement of governmental processes or distributional concerns.

If the action is a result of a statutory or judicial directive, you should state so clearly. You should also discuss the specific authority for your action, the extent of discretion available to you, and the regulatory instruments you might use.

**2. What Alternatives Should I Evaluate?** You should decide on and describe the number and choice of alternatives available to you and discuss the reasons for your choice. Alternatives that rely on incentives and offer increased flexibility are often more cost-effective than more prescriptive approaches. For example, user fees and information dissemination may be good alternatives to direct command-and-control regulation. Within a command-and-control regulatory program, performance-based standards may offer advantages over standards specifying design, behavior, or manner of compliance.

You should especially consider all appropriate alternatives for the key attributes or provisions of the rule.

*What are some alternative regulatory actions I should consider?*

- Informational Measures.
- Market-Based Approaches.
- Performance-Based Standards.
- Different Requirements for Different Segments of the Regulated Population.
- Alternative Levels of Stringency.

- Alternative Effective Dates of Compliance.
- Alternative Methods of Ensuring Compliance.

*Can you give me more specific examples?*

- **Informational Measures** - FDA requires labels showing the levels of nutrients and other ingredients that affect human health, rather than restricting these ingredients.
- **Market-Based Approaches** - EPA's "Acid Rain" program allows firms to trade permits to emit sulfur dioxide. This approach allows firms with high costs of controlling emissions to buy permits from low-cost firms, reducing the costs of the overall program while maintaining aggregate emissions reductions.
- **Performance Standards** - EPA sets automotive tailpipe emission standards in grams per mile traveled rather than requiring specific designs to achieve those ends. The National Highway Traffic Safety Administration (NHTSA) safety standards establish a permissible level of force that may act on occupants in a crash rather than setting specific mandatory vehicle designs.

Where there is a "continuum" of alternatives for a standard (for example, the level of stringency), you should generally analyze at least three options:

- the option serving as a focus for the Agency or program office regulatory initiative;
- a more stringent option that achieves additional benefits (and presumably costs more) beyond those realized by the preferred option; and
- a less stringent option that costs less (and presumably generates fewer benefits) than the preferred option.

You should choose options that are reasonable alternatives deserving careful consideration. In some cases, the regulatory program will focus on an option that is near or at the limit of technical feasibility or that fully achieves the objectives of the regulation. In these cases, the analysis would not need to examine a more stringent option. For each of the options analyzed, you should compare the anticipated benefits to the corresponding costs.

In some cases, you may decide to analyze a wide array of options. Thus, DOE's 1998 rule setting new energy efficiency standards for refrigerators and freezers analyzed a large number of options and produced a rich amount of information on their relative effects. This analysis -- examining more than 20 alternative performance standards for one class of refrigerators with top-mounted freezers -- enabled DOE to select an option that produced \$200 more in net benefits per refrigerator than the least attractive option.

You should analyze the benefits and costs of different regulatory provisions separately when a rule includes a number of distinct provisions. If the existence of one provision affects the benefits or costs arising from another provision, the analysis becomes more complicated, but the need to examine

provisions separately remains. In this case, you should evaluate each specific provision by determining the net benefits of the proposed regulation with and without it.

Analyzing all possible combinations of provisions in this way is impractical if their number is large and interaction effects are widespread. You need to use judgment to select the most significant or relevant provisions for such analysis.

You should also discuss the statutory requirements that affect the selection of regulatory approaches. If legal constraints prevent the selection of a regulatory action that best satisfies the philosophy and principles of Executive Order No.12866, you should identify these constraints and estimate their opportunity cost.

**3. How Do I Choose a Baseline?** You need to measure the benefits and costs of a rule against a baseline. This baseline should be the best assessment of the way the world would look absent the proposed regulation. The choice of a proper baseline may require consideration of a wide range of potential factors, including:

- evolution of the market,
- changes in external factors affecting benefits and costs,
- changes in regulations promulgated by the agency or other government entities, and the degree of compliance by regulated entities with other regulations.

You may often find it reasonable to forecast that the world absent the regulation will resemble the present. If you do so, however, your baseline should reflect the future effect of current programs and policies. For review of an existing regulation, a baseline assuming “no change” in the regulatory program generally provides an appropriate basis for evaluating reasonable regulatory alternatives. When more than one baseline is reasonable and the choice of baseline will significantly affect estimated benefits and costs, you should consider measuring benefits and costs against alternative baselines. In doing so you can analyze the effects on benefits and costs of making different assumptions about other agencies’ regulations, or the degree of compliance with your own existing rules. In all cases, you must evaluate benefits and costs against the same baseline. You should also discuss the reasonableness of the baselines used in these sensitivity analyses.

EPA’s 1998 final PCB disposal rule provides a good example. EPA used several alternative baselines, each reflecting a different interpretation of existing regulatory requirements. In particular, one baseline reflected a literal interpretation of EPA’s 1979 rule and another the actual implementation of that rule in the year immediately preceding the 1998 revision. The use of multiple baselines illustrated the substantial effect changes in EPA’s implementation policy could have on the cost of a regulatory program. In the years after EPA adopted the 1979 PCB disposal rule, changes in EPA policy -- especially allowing the disposal of automobile “shredder fluff” in municipal landfills -- reduced the cost of the program by more than \$500 million per year.

In some cases, substantial portions of a rule may simply restate statutory requirements that would be self-implementing even in the absence of the regulatory action. In these cases, you should use a pre-statute baseline. If you are able to separate out those areas where the agency has discretion, you may also use a post-statute baseline to evaluate the discretionary elements of the action.

**4. What Should I Do With Nonmonetized Benefits and Costs?** Although we prefer that agencies use acceptable monetized benefit and cost estimates, we recognize that monetizing some of the effects of regulations is difficult, if not impossible. Even quantifying some effects may not be easy.

a) What Should I Do With Benefits and Costs that are Difficult to Monetize?

You should monetize quantitative estimates whenever possible. Use commonly accepted values or procedures to monetize costs and benefits, and ensure that key analytical assumptions are defensible. If monetization is impossible, explain why and present all available quantitative information. For example, if you can quantify, but cannot monetize, improvements in water quality and increases in fish populations resulting from water quality regulation, you can describe benefits in terms of stream miles of improved water clarity for boaters and increases in game fish populations for anglers. You should also describe the timing and likelihood of such effects and avoid double-counting of benefits when estimates of monetized and physical effects are mixed in the same analysis.

b) What Should I Do With Benefits and Costs that are Even Difficult to Quantify?

Acceptable quantitative estimates of benefits and costs are preferable to qualitative descriptions of benefits and costs. Quantifying the effects of regulations can be difficult, however, and sometimes impossible. If quantification is difficult, you should present any relevant quantitative information along with a description of the unquantifiable effects. Such descriptions could include ecological gains, improvements in quality of life, and aesthetic beauty. For cases in which the presence of unquantifiable benefits or costs affects a policy choice, you should provide a clear explanation of the rationale behind the choice. Such an explanation could include detailed information on the nature, timing, likelihood, location, and distribution of the unquantified benefits and costs. Also, please include a summary table that lists all the unquantifiable benefits and costs, ordered by expected magnitude if possible.

**5. How Do I Take Into Account the Timing of Benefits and Costs?** To permit meaningful comparisons, you need to discount benefits and costs that occur in different time periods. The earlier that resources (goods or services) are available for consumption, the more people are willing to pay for them. One reason is that invested resources generally are productive. They earn positive rates of return. Another is that most people have needs they prefer to meet now rather than later. For example, in the absence of current assets, they willingly borrow (and pay interest) to satisfy those needs.

As a first step, you should consider presenting the streams of benefits and costs over time. These “raw” streams of benefits and costs can help you -- and your reader -- better understand the effects of alternative regulatory actions.

You should discount the constant-dollar benefits and costs that occur in different years to present values before combining them to get overall net benefits. You can deflate (that is, divide) benefit and cost estimates that are in nominal dollars by an appropriate inflation index to get constant dollar estimates. The stream of annualized estimates should begin in the year the final rule is published, even if the rule does not take effect immediately.

You will find the basic guidance on discount rates for regulatory and other analyses in OMB Circular A-94. The Circular specifies the use of a 7 percent real rate to discount the constant dollar estimates. The 7 percent rate is an estimate of the opportunity cost of capital, as measured by the before-tax rate of return to incremental private investment. We revised Circular A-94 in 1992 based on extensive review and public comment. It reflects the rates of return on low-yielding forms of capital, such as housing, as well as the higher rates of return on corporate capital.

In the A-94 guidance, we encourage you to present sensitivity analyses using other discount rates if you can justify the use of such alternative rates. An alternative that we often see used is the “social rate of time preference.” The social rate of time preference reflects the discount rate at which society is indifferent between a payment now and a correspondingly larger payment in a future year. It may be lower than the average real return on investment because, as a result of taxes and other distortions, individuals do not receive the full return on their investments. The economics literature identifies the government borrowing rate as a good measure of the social rate of time preference and most analysts use the average rate on long-term Treasury bonds. In recent years, this rate has been roughly 3 percent.

You may also use an alternative method based on the “shadow price” of capital.<sup>38</sup> Please check with us before using this method. You need to explain clearly your reason for proposing to use this approach instead of the recommended one.

EPA’s analysis of its 1998 rule setting both effluent limits for wastewater discharges and air toxic emission limits for pulp and paper mills developed present value estimates using discount rates of 3 and 7 percent for benefit and cost streams occurring over a 30 year period (See EPA, Economic Analysis ..., October 1997, pp.10-3 and 10-4). EPA phased in the recreational benefits over a two-year period reaching full value in year three. It phased in health benefits over a five year period reaching full value in

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<sup>38</sup> The shadow price of capital is the opportunity cost of diverting capital from one use to another. For a discussion of the shadow price approach, see Discounting for Time and Risk in Energy Policy by Robert C. Lind.

year six. EPA assumed that capital costs would occur in years one and twenty-one and operation and maintenance costs in years two through thirty. The analysis used OMB's recommended 7 percent discount rate, but also a 3 percent rate -- reflecting the social rate of time preference -- to show the sensitivity of its estimates to alternative rates.

Generally, economists do not adjust discount rates to account for the uncertainty of future benefits and costs. You should deal with risk and uncertainty using the principles presented in Section D.1 below, not by changing discount rates. Also, you should not adjust the discount rate for expected changes in the relative prices of goods over time. Instead, you should include directly any expected changes in relative prices in the benefit and cost estimates.

a) Special Case: Cost-Effectiveness Analysis - If you find it difficult to monetize benefits, you may consider using "cost-effectiveness" rather than "net benefits" analyses. If benefits occur at the same time as costs and the benefits remain the same over time, annualizing costs is sufficient and further discounting of non-monetized benefits is unnecessary. For example, the annualized cost per ton of reducing certain harmful emissions is often an appropriate measure of cost-effectiveness. If benefits occur later than costs -- such as improved health effects that occur only after long periods of exposure B you should discount for the delay between incurring the costs and the improvement in health effects.<sup>39</sup> In its 1998 rule, "Control of Emissions from Nonroad Diesel Engines," EPA estimated cost-effectiveness by using the 7 percent rate to discount both the costs and the emission reduction benefits over the useful life of the engines. As a general matter, cost effectiveness measures that account for all benefits and costs of the rule are preferable to those that omit substantial portions of either benefits or costs.

b) Special Case: Intergenerational Analysis - Special approaches may also be appropriate when comparing benefits and costs across generations. One approach is to follow the discounting method discussed above, and address the intergenerational equity and fairness issues explicitly, instead of modifying the discount rate.

One alternative approach is based on the perspective that this generation is concerned about the welfare of future generations and, in fact, is willing to defer consumption and invest or preserve resources for future use at a discount rate that is less than the discount rate used in making decisions within a generation. For this purpose, you could use as a discount rate a special rate of time preference based on the growth of per capita consumption. Again, check with us if you plan to use such an approach.

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<sup>39</sup> An equivalent approach is to determine the future value of costs as of the time you expect the benefits to occur.

## B. BENEFIT ESTIMATES

You should discuss the expected benefits of the selected regulatory option for each major final rule in your accounting statement and associated report. How is the proposed action expected to provide the anticipated benefits? What are the monetized values of all of the potential real incremental benefits to society? To present your results, you should:

- Include a schedule of monetized benefits that show the type and timing of benefits and express the estimates in this table in constant, undiscounted dollars.
- List the benefits you can quantify, but cannot monetize, including their timing.
- Describe benefits you cannot monetize or quantify, such as decreases in the risk of extinction of endangered species.
- Identify or cross-reference the data or studies on which you base the benefit estimates.

What should I do if my benefit estimates are uncertain?

- Normally, you should calculate benefits (including benefits of risk reductions) that reflect the full probability distribution of potential consequences. Where possible, present probability distributions of benefits and include the upper and lower bound estimates as complements to central tendency and other estimates.
- If fundamental scientific disagreement or lack of knowledge prevents construction of a scientifically defensible probability distribution, you should describe benefits under plausible assumptions and characterize the evidence underlying each alternative.

**1. What Key Concepts Do I Need to Know to Estimate Benefits?** The concept of "opportunity cost" is the appropriate construct for valuing both benefits and costs. The principle of "willingness-to-pay" captures the notion of opportunity cost by measuring what individuals are willing to forgo to enjoy a particular benefit. Market prices provide the richest data for estimating benefits based on willingness-to-pay if the goods and services affected by the regulation trade in free markets.

Estimating benefits when market prices are hard to measure or markets do not exist is more difficult. In these cases, regulatory analysts need to develop appropriate proxies that simulate market exchange. Estimates of willingness-to-pay based on observable and replicable behavior generally are the most reliable. As one example, analysts sometimes use "hedonic price equations" based on multiple regression analysis of market behavior to simulate market prices for the commodity of interest.<sup>40</sup> Going

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<sup>40</sup> The hedonic technique allows analysts to develop an estimate of the price for specific attributes associated with a product. For example, houses are a product characterized by a variety of attributes including the number of rooms, total floor area, and type of heating and cooling. If there is enough data on transactions in the housing

through the analytical process of deriving benefit estimates by simulating markets may also suggest alternative regulatory strategies that create such markets.

Other approaches may be necessary when a commodity is not directly or indirectly traded in markets. Valuation estimates developed using these approaches are less certain than benefit estimates derived from market transactions or based on behavior that is observable and replicable. While innovative benefit estimation methods are sometimes necessary, they increase the need for quality control to ensure that estimates conform closely to what would be observed if markets did exist.

Ultimately, the method selected to develop a monetized estimate should focus on a value for the specific attribute or benefit end-point of interest (for example, lost school-days). The transfer of a valuation estimate from an unrelated context (say, for example, the valuation of lost work-days from labor market studies) may yield a precise benefit estimate for the wrong attribute (that is, lost work-days).

You also need to guard against double-counting of benefits, since some benefits are embedded in other benefits. For example, when a regulation improves the quality of the environment in a community, the value of real estate in the community generally rises to reflect the greater attractiveness of living in a better environment. Simply adding the increase in property values to the benefits of improved public health would be double counting if the increase in property values reflects the improvement in public health. To avoid this problem you should separate the embedded effects on the value of property arising from improved public health.

**2. How Should I Value Benefits Directly Traded in Markets?** Economists ordinarily value goods and services at their market prices as the best measure of their value to society. In some instances, however, market prices may not reflect their true value to society. If a regulation involves changes to goods or services where the market price is not a good measure of the value to society, you should use an estimate that reflects the true value to society (often called the "shadow price"). For example, suppose a particular air pollutant damages crops. One of the benefits of controlling that pollutant is the value of the increase in crop yield as a result of the controls. That value is typically measured by the price of the crop. If the price is held above the market price by a government program that affects supply, however, a value estimate based on this price would overstate the true benefits of controlling the pollutant. In this case, you should calculate the value to society of the increase in crop yields by estimating the shadow price, which reflects the value to society of the marginal use of the crop. If the

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market, it is possible to develop an estimate of the implicit price for specific attributes, such as the implicit price of an additional bathroom or for central air conditioning. This technique can be extended, as well, to develop an estimate for the implicit price of public goods that are not directly traded in markets. For example, the analyst can develop implicit price estimates for public goods like air quality and access to public parks by adding measures for these attributes to the hedonic price equation for housing.

marginal use is for exports, you should use the world price. If the marginal use is to add to very large surplus stockpiles, you should use the value of the last units released from storage minus storage cost. If stockpiles are large and growing, the shadow price may be low or even negative.

**3. How Should I Value Benefits That Are Indirectly Traded in Markets?** Some benefits correspond to goods or services that are indirectly traded in the marketplace. Their value is reflected in the prices of related goods that are directly traded. Examples include reductions in health-and-safety risks, the use-values of environmental amenities (for example, recreational fishing or hiking and camping), and the value of improved scenic visibility. You should use willingness-to-pay measures as the basis for estimating the monetary value of such indirectly traded goods. When practical obstacles prevent the use of direct “revealed preference” methods based on actual market behavior to measure willingness-to-pay, you may consider the use of alternative “stated preference” methods based on survey techniques.

**4. How Should I Value Goods That Are Not Traded Directly or Indirectly in Markets?** Some types of goods -- such as preserving environmental or cultural amenities apart from their use and direct enjoyment by people (their so-called “nonuse” value) -- are not traded directly or indirectly in markets. Estimation of the benefits for these types of goods is even more difficult than for indirectly traded goods, because market-related transactions do not exist to provide data for willingness-to-pay estimates.

Stated preference methods using survey techniques, such as contingent valuation methods, may provide the only analytical approach currently available for estimating the values of many of these goods, particularly goods providing “nonuse” values. The lack of observable behavior for these goods, combined with their complex and often unfamiliar nature, calls for careful design and execution of these surveys. Confidence in their results requires rigorous analysis of the responses and full characterization of uncertainties. The use of studies that rely on the state of the art in survey design and implementation is important to assuring confidence in the results. In addition, these studies should satisfy checks on their internal consistency. For example, you should apply a “scope” test to show that individuals are willing to pay more for incrementally greater amounts of a good.

**5. How Should I Account for Health and Safety Benefits?** Regulations that address health and safety concerns may produce a variety of benefits -- those traded directly, those traded indirectly, and those not traded in markets. A key part of such regulations often is a reduction in the risk of illness, injury, or premature death. Above we outlined methods to use in developing benefit estimates; here we apply those methods to developing benefit estimates for these health and safety categories. Differences of opinion exist about the various approaches for monetizing risk reductions. In presenting health and safety benefits, you should include estimates of the risks both of nonfatal illness or injury and

of premature mortality. You should also describe any particular strengths or weaknesses characterizing the analyses you have used.

**(a) Nonfatal illness and injury.** Conceptually, a willingness-to-pay measure is superior to other measures, in part because it seeks to capture the value of pain and suffering and other quality-of-life effects. These quality-of-life effects can be a significant part of the benefits resulting from a particular regulatory action and should not be ignored. If well-conducted revealed-preference studies are available, you should consider these studies in developing your estimates. When well-conducted stated-preference studies are available, these studies can also provide estimates of the full willingness-to-pay for changes in morbidity risk.

Some agencies may find it impractical to develop such estimates because of the difficulty of measurement. Both revealed-preference and stated-preference studies may be unavailable or too unreliable to provide a solid base for evaluations. The only available estimates may be based on poorly designed and/or inappropriately applied stated preference studies (for example, contingent valuation surveys). Moreover, many injury-value estimates from stated preference studies are averages of specific combinations of injuries of varying severity. If the average injury severity in such a study differs greatly from the injury severity addressed by the regulatory action, that injury value will not accurately measure the value of the regulatory action. If these circumstances apply, you may prefer to describe reductions in risks of nonfatal illness or injury by using estimates of expected direct-costs-avoided (for example, cost-of-illness estimates).

Although you should use whatever approach is most appropriate, keep in mind that “cost-avoided” measures generally understate the true benefits. They may cause you to miss the value of reduced pain and suffering and other quality-of-life effects. If you choose to use such measures, you should acknowledge their limitations in identifying potential benefits from a regulatory action.

**(b) Fatality risks.** Since agencies often design health and safety regulation to reduce risks to life, evaluation of these benefits can be a key part of the analysis. In many cases, the expected reduction in fatality risk figures prominently as a reason for regulatory action. A good analysis must present these benefits clearly and show their importance. Agencies may choose to monetize these benefits to aid clear presentation. The willingness-to-pay approach is the best methodology to use if reductions in fatality risk are monetized.

Some describe the monetized value of small changes in fatality risk as the “value of statistical life” (VSL) or, less precisely, the “value of a life.” The latter phrase can be misleading because it suggests erroneously that the monetization exercise tries to place a “value” on individual lives. You should make it clear that these terms refer to the measurement of willingness to pay for reductions only in **small** risks of premature death. They have no application to an identifiable individual or to very large reductions in individual risks. They do not suggest that any individual’s life can be reduced to a mere monetary value. Their sole purpose is to help describe better the likely benefits of a regulatory action. Confusion about

the term "statistical life" is widespread. This term refers only to the sum of risk reductions expected in a population. For example, if the annual risk of death is reduced by one in a million for each of two million people, that is said to represent two "statistical lives" extended per year (two million x one millionth = two). If the annual risk of death is reduced by one in 10 million for each of 20 million people, that also is said to represent two "statistical lives" extended.

The adoption of a value for the projected reduction in the risk of premature mortality is the subject of continuing discussion within the economic and public policy analysis community. A considerable body of academic literature is available on this subject. The methods used and the resulting estimates vary substantially across these studies. Based on this literature, agencies are using estimates they believe appropriate for their particular regulatory circumstances. For example, in its "Roadway Worker Protection" rule, the Federal Railroad Administration (FRA) estimated benefits that include 22.9 discounted (statistical) lives extended over 10 years. Using a value of a statistical life of \$2.7 million, the FRA monetized this component of benefits at \$62 million. FDA adopted a value of \$2.5 million per statistical life for its recent tobacco rule and \$5 million for its mammography rule. EPA used a value of \$4.8 million per statistical life in developing its upper end benefit estimates for its rule setting ambient air standards for ozone and particulate matter.

Another way that has been used to express reductions in fatality risks is to use "value of statistical life-years extended" (VSLY). For example, if a regulation protects individuals whose average remaining life expectancy is 40 years, a risk reduction of one fatality is expressed as "40 life-years extended." Those who favor this alternative, age-adjusted approach emphasize that the value of a statistical life is not a single number relevant for all situations. In particular, when there are significant differences between the population affected by a particular health risk and the populations used in the labor market studies, they prefer to adjust the VSL estimate to reflect those differences. Based on this approach, FDA used a value of \$116,500 per life-year for its tobacco rule and \$368,000 per life-year in its mammography rule. You should keep in mind that regulations with greater numbers of life-years extended are not necessarily better than regulations with fewer numbers of life-years extended. Longevity may be only one of a number of relevant considerations pertaining to the rule.

The valuation of fatality risk reduction is an evolving area in terms of results and methodology. You should, accordingly, utilize valuation methods that you consider appropriate for the regulatory circumstances. You should present estimates based on alternative approaches, and if you monetize mortality risk reduction, you should do so on a consistent basis to the extent feasible. You should clearly indicate your methodology and document your choice of a particular methodology. If you use different methodologies in different rules, you should clearly disclose the fact and explain your reasons.

## C. COST ESTIMATES

**1. What Key Concepts Do I Need to Know to Estimate Costs?** The preferred measure of cost is the "opportunity cost" of the resources used or the benefits forgone as a result of the regulatory action. Opportunity costs include:

- private-sector compliance costs;
- government administrative costs;
- losses in consumers' or producers' surpluses;
- discomfort or inconvenience; and
- loss of time.

You should include these effects in your analysis and provide estimates of their monetary values wherever possible.

The opportunity cost of an alternative includes the value of the benefits forgone as a result of choosing that alternative. The opportunity cost of banning a product -- a drug, food additive, or hazardous chemical -- is the forgone net benefit of that product, taking into account the mitigating effects of potential substitutes. The use of any resource has an opportunity cost regardless of whether the resource is already owned or has to be purchased. That opportunity cost is equal to the net benefit the resource could provide in the absence of the requirement. For example, if regulation of an industrial plant affects the use of additional land or buildings within the existing plant boundary, the cost analysis should include the opportunity cost of using the additional land or facilities. To the extent possible, you should monetize any such forgone benefits and add them to the costs of that alternative. You should also try to monetize any costs averted as a result of an alternative and either add it to the benefits or subtract it from the costs of that alternative.

In calculating the incremental costs of a new regulation, you should compare them to a baseline (ordinarily no regulation or the existing regulation and, in any event, always the same as the baseline used for the benefit analysis) or a less stringent alternative. Incremental costs do not include future costs that occur even in the absence of the regulation, or costs that have already occurred (sunk costs). You should include a schedule of monetized costs that shows the type of cost and when it would occur; please express the numbers in this table as constant, undiscounted dollars.

As with benefit estimates, the calculation of costs should reflect the full probability distribution of potential results. You should use probability estimates to assign a weight to extreme values and other possible outcomes. If fundamental scientific disagreement or lack of knowledge precludes construction of a scientifically defensible probability distribution, you should describe costs using plausible alternative assumptions and present the evidence underlying each one. This approach generally produces a reasonable basis for an appropriate level of regulatory action.

**2. What Is the Difference Between Real Costs And Transfer Payments?** Distinguishing between real costs and transfer payments is an important, but sometimes difficult, problem in cost estimation. Cost estimates should reflect real resource costs. Transfer payments are monetary payments from one group to another that do not affect total resources available to society. For example, a regulation that restricts the supply of a good, causing its price to rise, produces a transfer of income from buyers to sellers. The reduction in the value of the supply of the good is a real cost to society, but the transfer of income from buyers to sellers resulting from the higher price is not. You should not include transfers in the estimates of the benefits and costs of a regulation. Instead, address them in a separate discussion of the regulation's distributional effects.

#### **D. OTHER KEY CONSIDERATIONS**

**1. How Do I Treat Risk and Uncertainty?** The effects of regulatory actions are not known with certainty, but can be predicted in terms of their probability of occurrence. The term "risk" in this document refers generally to a probability distribution over a set of outcomes. When the outcomes in question are hazards or injuries, risk refers to the probabilities of different potential severities of hazard or injury. The risk of cancer from exposure to a chemical means a change in the probability of contracting cancer caused by that exposure. There also are risks associated with economic benefits and costs; the risk of a financial loss of \$X means the probability of losing \$X.

The term "uncertainty" often is used in economic assessments as a synonym for risk. In this document, we use uncertainty to express a different concept, namely, that our knowledge of the probabilities and sets of possible outcomes that characterize a probability distribution of risks -- based on experimentation, statistical sampling, and other scientific tools -- is itself incomplete. Uncertainty arises from a variety of fundamentally different sources. They include lack of data, variability in populations and natural conditions, limitations in fundamental scientific knowledge (both social and natural), a resultant lack of knowledge about key relationships, and the fundamental unpredictability of various phenomena. Cost estimates also may be uncertain due to unknowns about opportunity costs or the compliance strategies of regulated entities.

Analysts often rely on statistical probability distributions for the values of those key elements that affect the estimates of risks, benefits, or costs. In these cases, some estimate of central tendency -- such as the mean or median -- should be used in addition to ranges, variances, specified low-end and high-end percentile estimates, and other characteristics of the distribution.

Overall risk, benefit, and cost estimates cannot be more precise than their most uncertain component. You should report these estimates in a way that reflects the degree of uncertainty present to prevent creating a false sense of precision. You should report quantitative estimates as accurately as supported by the quality of the data and models used. In all cases, you should explicitly state the level of precision.

The principles of full disclosure and transparency apply to the treatment of uncertainty in developing risk, benefit, and cost information -- just as it does with the other elements of economic analysis. You must identify data, models, and their implications for risk assessment in the risk characterization. You must also explicitly identify and evaluate the inferences and assumptions chosen and assess the effects of these choices on the analysis. If the uncertainty in the estimates -- for example, fundamental scientific disagreement or lack of knowledge -- prevents construction of a scientifically defensible probability distribution, you should describe the benefits and costs under plausible alternative assumptions.

**2. How Should I Treat Alternative Assumptions?** If benefit or cost estimates depend heavily on certain assumptions, you should make those assumptions explicit and carry out sensitivity analyses using plausible alternative assumptions. If the value of net benefits changes from positive to negative (or vice versa) or if the relative ranking of regulatory options changes with alternative plausible assumptions, you should conduct further analysis to determine which of the alternative assumptions is more appropriate. Because different estimation methods may have hidden assumptions, you should analyze estimation methods carefully to make any hidden assumptions explicit.

EPA's analysis for the two 1997 rules revising primary National Ambient Air Quality Standards (NAAQS) for ozone and particulate matter (PM) presented a plausible range of benefits estimates. The range reflected alternative assumptions for the estimates of specific benefit categories (See EPA, RIA for PM and ozone primary NAAQS, pp. ES-9 and 10). EPA listed high and low ozone benefit estimates, reflecting differences in the treatment of the possible effect of ozone on premature mortality, and high and low PM benefit estimates, reflecting differences in assumptions about different valuation approaches for reductions in premature mortality.

**3. How Should I Treat Distributional Effects and Equity Considerations?** Those who bear the costs of a regulation and those who enjoy its benefits often are not the same people. Regulations have "distributional effects" that affect different segments of the population and economy in various ways: by income groups, race, sex, industrial sector, and others. Regulations often distribute benefits and costs unevenly over time, perhaps spanning several generations. They also may distribute "transfer payments" unevenly. If these distributive effects are important, you should describe the effects of various regulatory alternatives quantitatively to the extent possible, including their magnitude, likelihood, and incidence of effects on particular groups. You should carefully analyze regulations that significantly affect outcomes for different groups. You should also analyze the changes in market prices caused by regulations, which may significantly redistribute income -- even if they are sometimes difficult to assess. Finally, you should list the time-streams of benefits and costs to provide a basis for judging distributional effects over periods of time, particularly when intergenerational effects are important.

Since generally accepted principles do not exist for determining when one distribution of net benefits is more equitable than another, you should describe distributional effects without judging their fairness. You should describe these effects broadly, focusing on large groups with small effects per capita, as well as on small groups experiencing large effects per capita. You should also note any equity issues

not related to the distribution of policy effects if they are important, and describe them quantitatively to the extent you can.

#### **4. What Should I Assume About Compliance?**

The effectiveness of proposed rules depends in part upon agency enforcement strategies, which may vary over time as priorities and budgetary constraints change. In cases where an enforcement strategy has not been established at the time of promulgation of the rule, you may assume complete compliance. In some cases, however, you may have reason to assume other levels of compliance as well. It is particularly important to do so where alternative enforcement strategies significantly affect the level of compliance or the costs of compliance. In that event, you should factor those assumptions into your analyses. Again, please use the same compliance assumption in estimating benefits and costs.

## Section II: Accounting Statement

You need to provide an accounting statement with tables reporting benefit and cost estimates for each major final rule for your agency. You should use the guidance outlined above to report these estimates. We have included a suggested format for your consideration.

**How Should We Categorize Benefits and Costs?** To the extent feasible, you should quantify all potential incremental benefits and costs. You should report benefit and cost estimates within the following three categories:

monetized;  
quantified, but not monetized; and  
qualitative, but not quantified.

These categories are mutually exclusive and exhaustive. Throughout the process of listing preliminary estimates of costs and benefits, agencies should avoid double-counting. This problem may arise if more than one way exists to express the same change in social welfare.

**Do We Need to Quantify and Monetize Whenever Possible?** Yes, you should develop quantitative estimates and convert them to dollar amounts if possible. In many cases, quantified estimates are readily convertible, with a little effort, into dollar equivalents.

**How Do We Deal With Time And Inflation?** You should monetize and quantify effects as real, undiscounted streams of estimates for each year over the entire period for which you have estimated them. You should also annualize these same effects -- expressed in equal annual equivalents -- using the real discount rate specified in OMB Circular A-94 (currently, 7 percent), unless we agree to a different discount rate for a particular regulation. The stream of annualized estimates should begin in the year the final rule is published even if the rule does not take effect immediately. Please report all monetized effects in 1996 dollars. You may convert dollars expressed in different years to 1996 dollars using the GDP deflator.

**How Do We Treat Risk and Uncertainty?** You should provide central tendency or primary estimates as well as distributions about those estimates, where such information exists. When you provide only upper and lower bounds (in addition to best estimates), you should, if possible, use the 95 and 5 percent confidence bounds. Although we encourage you to develop estimates that capture the distribution of plausible outcomes for a particular alternative, detailed reporting of such distributions is not required.

The principles of full disclosure and transparency apply to the treatment of uncertainty. Where there is significant uncertainty and the resulting inferences and/or assumptions have a critical effect on the benefit

and cost estimates, you should describe the benefits and costs under plausible alternative assumptions. You may add footnotes to the table as needed to provide documentation and references, or to express important warnings.

In our discussion in Section I above, we identified some of the issues associated with developing estimates of the value of reductions in premature mortality risk. Based on this discussion, you should present alternative primary estimates where you use alternative estimates for valuing reductions in premature mortality risk.

**How Do We Reflect Precision?** Reported estimates should reflect, to the extent feasible, the precision in the analysis. For example, an estimate of \$220 million implies rounding to the nearest \$10 million and thus a precision of +/- \$5 million; similarly, an estimate of \$222 million implies rounding to the nearest \$1 million and thus, a precision of +/- \$0.5 million.

**Do We Report Transfers Separately?** Yes, you should report transfers separately and avoid the misclassification of transfer payments as costs or benefits. Transfers occur when wealth or income is redistributed without any direct change in aggregate social welfare. To the extent that regulatory outputs reflect transfers rather than welfare gains to society, you should identify them as transfers rather than costs or benefits. You should also distinguish transfers caused by Federal budget actions -- such as those stemming from a rule affecting Social Security payments -- from those that involve transfers between non-governmental parties -- such as monopoly rents a rule may confer on a private party. You should use as many categories as necessary to describe the major redistributive effects of a regulatory action. If transfers have significant effects in addition to distributional effects, you should evaluate them also.

**What About Effects on State, Local, and Tribal Governments, Small Business, Wages and Economic Growth?** You need to identify the portions of benefits, costs, and transfers received by State, local, and tribal governments. To the extent feasible, you also should identify the effects of the rule or program on small businesses, wages, and economic growth. Note that rules with annual costs that are less than one billion dollars are likely to have a minimal effect on economic growth.

OMB #:  
 Rule Title:  
 RIN #:

Agency/Program Office:

Date:

<i>Category</i>	<i>Primary Estimate</i>	<i>Minimum Est.</i>	<i>Maximum Est.</i>	<i>Source Citation (RIA, preamble, etc.)</i>
<b>BENEFITS</b>				
<i>Annualized monetized benefits</i>				
<i>Annualized quantified, but unmonetized benefits</i>				
<i>Qualitative (unquantified) benefits</i>				
<b>COSTS</b>				
<i>Annualized monetized costs</i>				
<i>Annualized quantified, but unmonetized costs</i>				
<i>Qualitative (unquantified) costs</i>				
<b>TRANSFERS</b>				
<i>Annualized monetized transfers: Aon budget@</i>				
<i>from whom to whom?</i>				
<i>Annualized monetized transfers: Aoff budget@</i>				
<i>from whom to whom?</i>				

<i>Category</i>	<i>Effects</i>	<i>Source Citation (RIA, preamble, etc.)</i>
<i>Effects on State, Local, and/or Tribal Governments</i>		
<i>Effects on Small Businesses</i>		
<i>Effects on Wage</i>		
<i>Effects on Growth</i>		

## SELECTED FURTHER READINGS

Judith D. Bentkover, Vincent T. Covello, and Jeryl Mumpower, Eds., *Benefits Assessment: The State of the Art*. Dordrecht; Boston: D. Reidel Pub. Co.; Hingham, MA, U.S.A.: Sold and distributed in the U.S.A. and Canada by Kluwer Academic, 1986.

Jack Hirshliefer and John G. Riley, *The Analytics of Uncertainty and Information*. An advanced treatment of many issues related to risk and uncertainty. Cambridge; New York: Cambridge University Press, 1992.

Myrick Freeman, *The Measurement of Environmental and Resource Values: Theory and Methods*. A comprehensive high-level treatment of environmental valuation issues. Washington, D.C.: Resources for the Future, 1993.

Robert C. Lind, Ed., *Discounting for Time and Risk in Energy Policy*. An advanced treatment of issues related to public and private sector discounting. Washington, D.C.: Resources for the Future; Baltimore: Distributed by the Johns Hopkins University Press, 1982.

E. J. Mishan, *Economics for Social Decisions: Elements of Cost-Benefit Analysis*. Assumes some knowledge of economics. Chapters 5-8 should be helpful on the important subjects of producers' and consumers' surpluses (not discussed extensively in this guidance document). New York: Praeger, 1973.

Robert Cameron Mitchell and Richard T. Carson, *Using Surveys to Value Public Goods: The Contingent Valuation Method*. Provides a valuable discussion on the potential strengths and pitfalls associated with the use of contingent-valuation methods. Washington, D.C.: Resources for the Future; [Baltimore]: Distributed worldwide by the Johns Hopkins University Press, 1989.

V. Kerry Smith, Ed., *Advances in Applied Micro-economics: Risk, Uncertainty, and the Valuation of Benefits and Costs*. JAI Press., Inc., 1986.

Edith Stokey and Richard Zeckhauser, *A Primer for Policy Analysis*. Chapters 9 and 10 provide a good introduction to basic concepts. New York: W.W. Norton, 1978.

George Tolley, Donald Kenkel, and Robert Fabian, Eds., *Valuing Health for Policy: An Economic Approach*. An excellent summary of methods to value reduction in morbidity and extensions to life expectancy. Chicago: University of Chicago Press, 1994.

W. Kip Viscusi, *Fatal Tradeoffs*. Part I is a good starting point for the topic of valuing health and safety benefits. Other more technical sources are given in the bibliography. New York: Oxford University Press, 1992.