# Frequently Asked Questions on Mortality Risk Valuation

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This page contains information on Frequently Asked Questions on Mortality Risk Valuation and EPA practices concerning the use and measurement of the "Value of a Statistical Life" as it is applied in EPA economic analyses.

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**What does it mean to place a value on life?**

The EPA does not place a dollar value on individual lives. Rather, when conducting a benefit-cost analysis of new environmental policies, the Agency uses estimates of how much people are willing to pay for small reductions in their risks of dying from adverse health conditions that may be caused by environmental pollution.

In the scientific literature, these estimates of willingness to pay for small reductions in mortality risks are often referred to as the "value of a statistical life." This is because these values are typically reported in units that match the aggregate dollar amount that a large group of people would be willing to pay for a reduction in their individual risks of dying in a year, such that we would expect one fewer death among the group during that year on average. This is best explained by way of an example. Suppose each person in a sample of 100,000 people were asked how much he or she would be willing to pay for a reduction in their individual risk of dying of 1 in 100,000, or 0.001%, over the next year. Since this reduction in risk would mean that we would expect one fewer death among the sample of 100,000 people over the next year on average, this is sometimes described as "one statistical life saved." Now suppose that the average response to this hypothetical question was $100. Then the total dollar amount that the group would be willing to pay to save one statistical life in a year would be $100 per person × 100,000 people, or $10 million. This is what is meant by the "value of a statistical life." Importantly, this is not an estimate of how much money any single individual or group would be willing to pay to prevent the certain death of any particular person.

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**Why do Agencies attempt to value risk reductions in dollars?**

Agencies use estimates of values of risk reductions when conducting a benefit-cost analysis of a new policy or regulation that may affect public health. For example, many of the air and water pollution control regulations that are implemented by the EPA will reduce the risks of certain types of cancers, respiratory illnesses, and other diseases among large portions of the general public. Benefit-cost analysis compares the total willingness to pay for the health risk reductions from these policies to the additional costs that people will bear if the policies are adopted. These costs may come in the form of increased taxes, or, more commonly, increased prices of goods and services whose production, use, or disposal contributes to environmental pollution. The results of a benefit-cost analysis are presented to policy-makers and the public to help inform their judgments regarding whether or not a proposed policy should be adopted.

Only one federal environmental statute, the Safe Drinking Water Act, explicitly calls for the kind of formal benefit-cost analysis describe here. Most environmental laws do not require benefit-cost analysis, and some prohibit it (e.g., the air quality standards provisions of the Clean Air Act). Nevertheless, Presidential Executive Orders have required or encouraged the use of benefit-cost analysis in policy evaluation since the early 1980's. For "major" regulations—those expected to have an impact on the economy of $100 million or more—federal agencies are required by Executive Order 12866 to conduct a formal benefit-cost analysis as a way of informing both policy makers and the public.

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**What is Benefit-Cost Analysis?**

Benefit-cost analysis is an analytical tool used to evaluate public policy options. For environmental policies, benefits are determined by what individuals would be willing to pay for risk reductions or for other improvements from pollution prevention. Costs are determined by the dollar value of the resources directed to pollution reduction. If the total benefits exceed the total

costs, then the policy is said to "pass a benefit-cost test."

Of course in most cases where the total benefits exceed total costs, it will *not* be true that the benefits exceed the costs for each and every person affected by the policy; rather, some individuals will gain and others will lose. However, if the total benefits are greater than the costs, then it is *in principle* possible for those who gain to compensate those who lose so that everyone could be better off with the policy. This is what it means for a policy to pass a benefit-cost test.

The benefit-cost test alone is not the only relevant criterion for evaluating public policies since it omits important aspects of the policy decision. In particular, the benefit-cost criterion does not consider the distribution of benefits and costs among the affected individuals. These distributional effects often will be important to policy-makers and the general, so benefit-cost analysis typically will need to be supplemented by other information.

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**What is Benefit-Cost Analysis used for?**

The primary purpose of benefit cost analysis is to provide policy makers and others with detailed information on a wide variety of consequences of environmental policies.

Benefit-cost analysis is only one of many inputs into policy evaluation. Other factors include environmental justice considerations; ethical concerns; enforceability; legal consistency; and technological and institutional feasibility.

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**What is the "Value of a Statistical Life"?**

See "~~What does it mean to place a value on life?~~"

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**What value of statistical life does EPA use?**

EPA recommends that the central estimate of $7.4 million ($2006), updated to the year of the analysis, be used in all benefits analyses that seek to quantify mortality risk reduction benefits regardless of the age, income, or other population characteristics of the affected population until revised guidance becomes available (see "~~What is the current process for updating the Agency's estimates~~" below). This approach was vetted and endorsed by the Agency when the 2000 ~~*Guidelines for Preparing Economic Analyses*~~ were drafted. Although $7.4 million ($2006) remains EPA's default guidance for valuing mortality risk changes, the Agency has considered and presented others (see "~~What Values Has EPA Used in the Past~~" below.)
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**What other values has EPA used in the past?**

Few economic analyses prepared by EPA calculated monetary benefits until the mid-1980s. One of the earliest major EPA regulations that developed more detailed economic estimates of the benefits of proposed regulatory standards was the National Ambient Air Quality Standards for particulate matter (USEPA 1984). This analysis drew on a review of six wage-risk studies published during 1976-1981 with a central estimate of $4.6 million (2001$). Around this same time EPA issued its first economic guidance and reported a range of VSL estimates for use in policy

analysis of $0.7 to $12.9 million (2001$) (USEPA 1983). The next major review of mortality risk valuation came in the mid-1990s when EPA reported to Congress on the economic benefits and costs of the Clean Air Act (USEPA 1997). This report based its VSL findings on 26 studies, 21 from the wage-risk literature and five from stated preference studies. This study forms the basis of EPA's existing mortality risk valuation guidance discussed above.

Beginning in 2004 EPA's Office of Air and Radiation (OAR) used an estimate of $5.5 million (1999 dollars; $6.6 million in 2006 dollars) for the analysis of air regulations. This estimate was derived from the range of values estimated in three meta-analyses of VSL conducted after EPA's *Guidelines* were published in 2000 (Mrozek and Taylor (2000), Viscusi and Aldy (2003), and later, Kochi, et al. (2006).) However, the Agency neither changed its official guidance on the use of VSL in rule-makings nor subjected the interim estimate to a scientific peer-review process through the Science Advisory Board (SAB) or other peer-review group.

While the Agency is updating its guidance by incorporating the most up-to-date literature and recent recommendations from the SAB-EEAC, it has determined that a single, peer-reviewed estimate applied consistently best reflects the SAB-EEAC advice until updated guidance is available. Therefore, EPA has decided to return to the value established in the 2000 *Guidelines* for all its actions until a revised estimate can be fully vetted within the Agency and by EPA's Science Advisory Board.

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**What is the current process for updating the Agency's estimates?**

EPA is committed to using the best available science in its analyses and is in the process of revisiting its guidance on valuing mortality risk reductions.

- EPA has engaged the Science Advisory Board Environmental Economics Advisory Committee (SAB-EEAC) on several issues related to mortality risk valuation, including the use of meta-analysis – a statistical technique used to combine results from individual studies addressing similar problems.
- Following advice of the SAB-EEAC, EPA formed an expert panel to explore issues of meta-analysis (see USEPA 2006).
- In addition, EPA commissioned reports on the various approaches used in the literature to estimate the value of mortality risk reductions (Alberini 2004, Black *et al*. 2003, and Blomquist 2004).

EPA is now taking all of this information into account in the guidance revision process. The Agency has prepared a white paper on ~~*Valuing Mortality Risk Reductions in Environmental Policy*~~ (PDF, 1795.3K, ~~About PDF~~) featuring EPA's latest review of important issues surrounding how to value the reductions in risk to human health from environmental regulations and other Agency decisions. EPA has submitted the whitepaper to its Science Advisory Board for feedback and recommendations on several issues including:

- replacing the often misunderstood term "value of statistical life" with the more accurate term "value of mortality risk reduction;"
- accounting for potential differences in people's willingness to pay for cancer mortality risk reductions relative to mortality risks from workplace or other accidental deaths when estimating the benefits of actions that are expected to reduce cancer-causing pollutants;
- accounting for possible differences in people's willingness to pay for risk reductions that will be experienced by others due to altruistic preferences in benefit-cost estimation; and
- synthesizing the body of evidence of people's willingness-to-pay for reducing mortality risks to inform benefit-cost analysis.

The process ultimately used to revise estimates for use in benefit-cost analysis will be informed by the recommendations from the SAB Review.

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**Why is EPA proposing to change the terminology it uses when valuing changes in mortality risk?**

The Agency believes that its benefit-cost analyses would be more transparent and comprehensible if the term "value of statistical life" were replaced with an alternative term that more accurately describes the health risk changes that are being analyzed. The term "value of statistical life" can give the misleading impression that a "price" is being placed on individual lives--as a mugger who says, "Your money or your life!?" In reality, EPA regulations typically lead to small reductions in mortality risks (ranging up to 1 in 1,000 per year) for large numbers of people. A benefit-cost analysis attempts to estimate the total sum of money that a large number of people would be willing to pay to reduce their mortality risks by amounts in this general range. The term "value of mortality risk reduction" conveys this idea more clearly and should reduce the confusion that sometimes arises when discussing the "value of statistical lives." It is important to understand that by adopting new terminology the Agency is not changing the economic theory that underlies these valuations. Furthermore, no matter which term is applied, the same underlying data would be used to estimate the value, and these values would lead to the same aggregate benefits if applied to the same policy proposal.

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**How does the "Value of Mortality Risk" Differ from the Value of a Statistical Life?**

The Value of Mortality Risk (VMR) and the Value of Statistical Life (VSL) are indeed related. The underlying theoretical concept is the same, and the estimated values for either metric would be based on the same published literature. The difference lies in the choice of units used to aggregate and report the risk changes. The VSL is typically reported in units of dollars per statistical death per year. The VMR would be reported in units such as dollars per micro-risk per person per year, where a "micro-risk" represents a one in a million chance of dying. EPA is proposing using VMR because it should help to reduce the misunderstandings that are sometimes caused by the VSL terminology.

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**How will EPA Estimate the Value of Mortality Risk (VMR)?**

For decades economists have been studying how people make tradeoffs between their own income and risks to their health and safety. These tradeoffs can reveal how people value, in dollar terms, small changes in risk. For example, purchasing automobile safety options reveals information on what people are willing to pay to reduce their risk of dying in a car accident. Purchasing smoke detectors reveals information on what people are willing to pay to reduce their risk of dying in a fire. EPA will review all of the peer-reviewed scientific studies of these income and health risk trade-offs and will attempt to summarize the results in a single best central estimate or range of estimates to use in benefit-cost analyses.

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**Is EPA proposing a numeric value for VMR?**

No, EPA is not proposing a numeric value for VMR at this time. The White Paper under review by the SAB-EEAC proposes a methodology for both incorporating the latest scientific evidence on how people value small reductions in their risk of dying and combining the estimates in the over 80 studies in the literature. EPA has identified a set of criteria for selecting studies from the literature and outlined a method for identifying appropriate estimates from those studies. The

White Paper highlights a number of statistical issues that are associated with combining estimates from the studies and is seeking SAB feedback on how best to address these issues. EPA has proposed several options for identifying the best estimate or set of estimates for a VMR, but does not propose a value in this White Paper.

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**What is a Cancer Differential?**

A cancer differential is the additional amount that people are willing to pay to reduce cancer risks relative to accidental or other categories of mortality risks. In part, this may reflect the extended period of illness that accompanies life-threatening cancer, but it may also include intangible factors such as the additional feeling of dread associated with cancer. If people value different types of risk differently, then benefits analysis for different types of policies would ideally reflect these preferences. As described in the *White Paper on Valuing Mortality Risk Reductions in Environmental Policy*, EPA believes there is now sufficient scientific evidence for including a cancer differential in economic analysis of policies that reduce exposure to cancer-causing pollutants. This issue is one of the subjects for EPA's upcoming consultation with the Environmental Economics Advisory Committee of the Science Advisory Board.

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**What are Altruistic Preferences?**

Altruism is the concern for others. We know from studies that individuals are often willing to pay more when there are reductions in risks to themselves as well as others. That is, many studies show that individuals express altruism when asked how much they would be willing to pay to reduce risks to themselves as well as other people. Since most environmental policy addresses public risks that we all face in common, then it may be important to capture these altruistic preferences in our benefit-cost analysis. This issue is one of the subjects for EPA's upcoming consultation with the Environmental Economics Advisory Committee of the Science Advisory Board.

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**When will revised Guidance on Mortality Risk Valuation be available?**

Producing Agency guidance on mortality risk valuation is a multi-step process and will, in part, depend on the recommendations received from the Science Advisory Board. Clear guidance based on the best available scientific information that can be consistently applied across the Agency is the goal. While this may take some time to complete, the goal is to issue new guidance in 2011.

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