

EPA, 2000a), and 7 percent which is recommended by OMB Circular A-94 (OMB, 1992).

More specifically, the base estimate of benefits reflects the use of peer-reviewed methodologies developed for earlier risk and benefit-cost assessments related to the Clean Air Act, such as the regulatory assessments of the Heavy Duty Diesel and Tier II rules and the section 812 Report to Congress. The alternative estimate explores important aspects of the key elements underlying estimates of the benefits of reducing PM and SO<sub>2</sub> emissions, specifically focusing on estimation and valuation of mortality risk reduction and valuation of chronic bronchitis. The alternative estimate of mortality reduction relies on recent scientific studies finding an association between increased mortality and short-term exposure to particulate matter over days to weeks, while the base estimate relies on a recent reanalysis of earlier studies that associate long-term exposure to fine particles with increased mortality. The alternative estimate differs in the following ways: it explicitly omits any impact of long-term exposure on premature mortality, it uses different data on valuation and makes adjustments relating to the health status and potential longevity of the populations most likely affected by PM, it also uses a cost-of-illness method to value reductions in cases of chronic bronchitis while the base estimate is based on individual's willingness to pay (WTP) to avoid a case of chronic bronchitis. In addition, one key area of uncertainty is the value of a statistical life (VSL) for risk reductions in mortality, which is also the category of

benefits that accounts for a large portion of the total benefit estimate. 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. There is general agreement that the value to an individual of a reduction in mortality risk can vary based on several factors, including the age of the individual, the type of risk, the level of control the individual has over the risk, the individual's attitude toward risk, and the health status of the individual.

The Environmental Economics Advisory Committee (EEAC) of the EPA Science Advisory Board (SAB) recently issued an advisory report which states that "the theoretically appropriate method is to calculate willingness to pay for individuals whose ages correspond to those of the affected population, and that it is preferable to base these calculations on empirical estimates of WTP by age." (EPA-SAB-EEAC-00-013). In developing our base estimate of the benefits of premature mortality reductions, we have appropriately discounted over the lag period between exposure and premature mortality. However, the empirical basis for adjusting the current \$6 million VSL for other factors does not yet justify including these in our base estimate. A discussion of these factors is contained in the RIA and supporting documents. The EPA recognizes the need for additional research by the scientific community to develop additional empirical support for adjustments to VSL for the factors mentioned above. Furthermore, EPA prefers not to draw

distinctions in the monetary value assigned to the lives saved even if they differ in age, health status, socioeconomic status, gender or other characteristic of the adult population.

Given the advice from the SAB, we employed the suggested approach for the benefit analysis of the Heavy Duty Engine/Diesel Fuel standards conducted in 2000 to the Industrial, Commercial, and Institutional Boiler and Process Heater MACT discussed in this preamble. A full discussion of considerations made in our presentation of benefits is summarized in the preamble of the Final Heavy Duty Diesel Program issued in December 2000, and in all supporting documentation and analyses of the Heavy Duty Diesel Program, and in the RIA for the proposed rulemaking.

In addition to the presentation of mortality valuation, our estimate also includes a "B" to represent those additional health and environmental benefits which could not be expressed in quantitative incidence and/or economic value terms. A full listing of the benefit categories that could not be quantified or monetized in our estimate are provided in the RIA for the proposed rule. A full appreciation of the overall economic consequences of the proposed industrial boiler and process heater standards requires consideration of all benefits and costs expected to result from today's proposed rule, not just those benefits and costs which could be expressed here in dollar terms. A full listing of the benefit categories that could not be quantified or monetized in our estimate are provided in Table 5 of this preamble.

TABLE 5.—UNQUANTIFIED BENEFIT CATEGORIES

	Unquantified benefit categories associated with HAP	Unquantified benefit categories associated with PM
Health Categories .....	Airway responsiveness Pulmonary inflammation Increased susceptibility to respiratory infection Acute inflammation and respiratory cell damage Chronic respiratory damage/Premature aging of lungs Emergency room visits for asthma	Changes in pulmonary function. Morphological changes. Altered host defense mechanisms. Cancer. Other chronic respiratory disease. Emergency room visits for asthma. Emergency room visits for non-asthma respiratory and cardiovascular causes. Lower and upper respiratory symptoms. Acute bronchitis. Shortness of breath. Increased school absence rates.
Welfare Categories .....	Ecosystem and vegetation effects Damage to urban ornamentals (e.g., grass, flowers, shrubs, and trees in urban areas) Commercial field crops Fruit and vegetable crops Reduced yields of tree seedlings, commercial and non-commercial forests Damage to ecosystems Materials damage	Materials damage. Damage to ecosystems (e.g., acid sulfate deposition). Nitrates in drinking water. Visibility in recreational and residential areas.