

- When appropriate, use data from non-U.S. studies to broaden age ranges to which current estimates apply and to include more types of relevant health outcomes; and
- Begin to move the assessment of uncertainties from its ancillary analyses into its primary analyses by conducting probabilistic, multiple-source uncertainty analyses. This assessment should be based on available data and expert judgment.

Although the NAS made a number of recommendations for improvement in EPA's approach, it found that the studies selected by EPA for use in its benefits analysis were generally reasonable choices. In particular, the NAS agreed with EPA's decision to use cohort studies to derive benefits estimates. It also concluded that the Agency's selection of the American Cancer Society (ACS) study for the evaluation of PM-related premature mortality was reasonable, although it noted the publication of new cohort studies that should be evaluated by the Agency.

Several of the NAS recommendations addressed the issue of uncertainty and how the Agency can better analyze and communicate the uncertainties associated with its benefits assessments. In particular, the Committee expressed concern about the Agency's reliance on a single value from its analysis and suggested that EPA develop a probabilistic approach for analyzing the health benefits of proposed regulatory actions. The Agency agrees with this suggestion and is working to develop such an approach for use in future rulemakings.

In this benefits analysis for the proposed rule, the Agency has used an interim approach that shows the impact of several important alternative assumptions about the estimation and valuation of reductions in premature mortality and chronic bronchitis. This approach, which was developed in the context of the Agency's Clear Skies analysis, provides an alternative estimate of health benefits using the time series studies in place of cohort studies, as well as alternative valuation methods for mortality and chronic bronchitis risk reductions.

For the proposed rule, we conducted an air quality assessment to determine the change in ambient concentrations of PM₁₀ and PM_{2.5} that result from reductions of PM and SO₂ at existing affected facilities. Our air quality analysis was conducted using the source-receptor (S-R) matrix model, a model that provides changes in PM₁₀ and PM_{2.5} concentrations based on

changes in PM and/or PM precursor emissions. Unfortunately, our data is not able to define the exact location of the reductions for every affected boiler and process heater. The air quality analysis was conducted for emissions reductions from those emissions sources that have a known link to a specific control device, which represents approximately 50 percent of the total emissions reductions mentioned above. Using this subset of information, we utilized the S-R matrix to determine the air quality change nationwide. The results of the air quality assessment served as input to a model that estimates the total monetary value of benefits of the health effects listed above. Total benefits associated with this portion of the analysis are \$8.2 billion in the year 2005 (presented in 1999 dollars).

For those emissions reductions from affected sources that do not have a known link to a specific control device, the results of the air quality analysis serve as a reasonable approximation of air quality changes to transfer to the remaining emissions reductions of the proposed rule. Because there is not a reasonable way to apportion the total benefits of the combined impact of the PM and SO₂ reductions from the air quality and benefit analyses completed above, we performed two additional S-R matrix analyses. One analysis was performed to evaluate the impact on air quality of the PM reductions alone (holding SO₂ unchanged), and one to evaluate the impact on air quality from the SO₂ reductions alone (holding PM unchanged). With independent PM and SO₂ air quality assessments, we can determine the total benefit associated with each component of total pollutant reductions. The total benefit associated with the PM and SO₂ reductions with unspecified location are \$7.9 billion.

Every benefit-cost analysis examining the potential effects of a change in environmental protection requirements is limited to some extent by data gaps, limitations in model capabilities (such as geographic coverage), and uncertainties in the underlying scientific and economic studies used to configure the benefit and cost models. Deficiencies in the scientific literature often result in the inability to estimate changes in health and environmental effects, such as potential increases in premature mortality associated with increased exposure to carbon monoxide. Deficiencies in the economics literature often result in the inability to assign economic values even to those health and environmental outcomes which can be quantified. While these general uncertainties in the underlying

scientific and economics literatures are discussed in detail in the RIA and its supporting documents and references, the key uncertainties which have a bearing on the results of the benefit-cost analysis of today's action are the following:

1. The exclusion of potentially significant benefit categories (*e.g.*, health and ecological benefits of reduction in hazardous air pollutants emissions);
2. Errors in measurement and projection for variables such as population growth;
3. Uncertainties in the estimation of future year emissions inventories and air quality;
4. Uncertainties associated with the extrapolation of air quality monitoring data to some unmonitored areas required to better capture the effects of the standards on the affected population;
5. Variability in the estimated relationships of health and welfare effects to changes in pollutant concentrations; and
6. Uncertainties associated with the benefit transfer approach.

Despite these uncertainties, we believe the benefit-cost analysis provides a reasonable indication of the expected economic benefits of the industrial boilers and process heaters MACT under two different sets of assumptions.

We have used two approaches (base and alternative estimates) to provide benefits in health effects and in monetary terms. They differ in the method used to estimate and value reduced incidences of mortality and chronic bronchitis, which is explained in detail in the RIA. While there is a substantial difference in the specific estimates, both approaches show that the industrial boilers and process heaters MACT may provide benefits to public health, whether expressed as health improvements or as economic benefits. These include prolonging lives, reducing cases of chronic bronchitis and hospital admissions, and reducing thousands of cases in other indicators of adverse health effects, such as work loss days, restricted activity days, and days with asthma attacks. In addition, there are a number of health and environmental effects which we were unable to quantify or monetize. These effects, denoted by "B" are additive to the both the base and alternative estimates of benefits. Results also reflect the use of two different discount rates for the valuation of reduced incidences of mortality; a 3 percent rate which is recommended by EPA's Guidelines for Preparing Economic Analyses (U.S.