

13.0 BENEFIT-COST COMPARISONS

13.1 RESULTS IN BRIEF

Estimated partial attainment (P/A) benefits of implementation of the particulate matter (PM) and ozone NAAQS greatly exceed estimated P/A costs. Estimated combined net P/A benefits (P/A benefits minus P/A costs) for the combined PM_{2.5} 15/65 and ozone 0.08 4th max alternatives range from approximately \$10 to \$96 billion.

Considered separately, estimated P/A benefits of alternative PM_{2.5} standards far outweigh estimated P/A costs. Estimated quantifiable net P/A benefits of the selected PM_{2.5} 15/65 standard range from \$10 to \$95 billion. Estimated quantifiable full-attainment (F/A) net benefits range from negative \$18 to positive \$67 billion. Estimated quantifiable net P/A quantified and monetized benefits of the ozone 0.08 4th max standard range from negative \$0.7 to positive \$1.0 billion. F/A benefit estimates are somewhat smaller than F/A cost estimates. Quantifiable net benefits for full attainment of the 0.08 4th max. ozone standard are estimated to range from negative \$1.1 to negative \$8.1 billion.

13.2 INTRODUCTION

This Regulatory Impact Analysis provides cost, economic impact, and benefit estimates potentially useful for evaluating PM, ozone, and RH control alternatives. Benefit-cost analysis provides a systematic framework for assessing and comparing such alternatives. According to economic theory, the efficient alternative maximizes net benefits to society (i.e., social benefits minus social costs). However, both the Agency and the courts have defined the primary National Ambient Air Quality Standards (NAAQS) setting process as a fundamentally health-based decision that specifically is not to be based on cost or other economic considerations. This benefit-cost comparison for the PM and ozone NAAQS, therefore, is intended to generally inform the public about the potential costs and benefits that may result when revisions to the PM

and ozone NAAQS are implemented by the States. The benefit-cost comparison for the RH rule, however, may be used to support the decision making process for this program.

13.3 COMPARISONS OF BENEFITS TO COSTS

13.3.1 Separate PM and Ozone NAAQS

13.3.1.1 Results

Tables 13.1 and 13.2 present the estimated P/A benefits, costs, net benefits, and residual nonattainment area (RNA) results for alternative PM_{2.5} NAAQS and ozone NAAQS, respectively.

Full attainment (F/A) cost and benefit estimates of alternative PM_{2.5} and ozone NAAQS are presented in Chapters 9 and 12. Estimated F/A costs of the selected PM_{2.5} 15/65 standard equal \$36.7 billion, while estimated F/A benefits range from \$19.8 to \$109.7 billion. Estimated F/A costs of the ozone 0.08 4th max standard equal \$9.6 billion, while estimated F/A benefits range from \$1.5 to \$8.5 billion.

13.3.1.2 Key Results and Conclusions

- Monetized net benefit estimates are positive and substantial for all three PM_{2.5} alternatives for the P/A scenario. For the selected PM_{2.5} 15/65 standard, estimated net annual P/A benefits range from \$10 to \$95 billion, depending whether the estimates are based on the low end and high end assumptions.
- Monetized net benefit estimates are ambiguous for the three ozone standards assessed for the P/A scenario. For the selected ozone 0.08 4th max standard, estimated net annual P/A benefits range from negative \$0.7 billion to positive \$1.0 billion, depending on whether the estimates are based on the low or the high end assumptions. Note that

significant categories of nonmonetized benefits are omitted from these estimates.

Table 13.1 Comparison of Annual Benefits and Costs of PM Alternatives in 2010^{a,b} (1990\$)

PM_{2.5} Alternative (µg/m³)	Annual Benefits of Partial Attainment^c (billion \$) (A)	Annual Costs of Partial Attainment (billion \$) (B)	Net Benefits of Partial Attainment (billion \$) (A - B)	Number of Residual Nonattainment Counties
16/65 (high end estimate)	90	5.5	85	19
15/65 (low end estimate) (high end estimate)	19 - 104	8.6	10 - 95	30
15/50 (high end estimate)	108	9.4	98	41

- a All estimates are measured incremental to partial attainment of the current PM₁₀ standard (PM₁₀ 50/150, 1 expected exceedance per year).
- b The results for 16/65 and 15/50 are only for the high end assumptions range. The low end estimates were not calculated for these alternatives.
- c Partial attainment benefits based upon post-control air quality as defined in the control cost analysis.

**Table 13.2 Comparison of Annual Benefits and Costs of Ozone Alternatives in 2010^{a,b}
(1990\$)**

Ozone Alternative (ppm)	Annual Benefits of Partial Attainment (billion \$)^c (A)	Annual Costs of Partial Attainment (billion \$) (B)	Net Benefits of Partial Attainment (billion \$) (A - B)	Number of Residual Nonattainment Areas
0.08 5th Max (high end estimate)	1.6	0.9	0.7	12
0.08 4th Max (low end estimate) (high end estimate)	0.4 - 2.1	1.1	(0.7) - 1.0	17
0.08 3rd Max (high end estimate)	2.9	1.4	1.5	27

- a All estimates are measured incremental to partial attainment of the baseline current ozone standard (0.12ppm , 1 expected exceedance per year).
- b The results for .08, 5th and .08, 3rd max. are only for the high end assumptions. The low end estimates were not calculated for these alternatives.
- c Partial attainment benefits based upon post-control air quality estimates as defined in the control cost analysis.

13.3.2 Combined PM and Ozone NAAQS

Based on results from sensitivity studies performed for the sequential implementation of a PM and an ozone standard (see Appendix D), the sum of estimated P/A costs and benefits associated with separate PM and ozone standards, regardless of sequence, is likely to exceed the P/A costs and benefits associated with coordinated implementation of both standards, but only by a small percentage. Thus the benefits and costs of coordinated implementation of a PM_{2.5} 15/65 and ozone 0.08 4th max standards can be estimated roughly by summing results from the separate standards analyses.

13.3.3 Regional Haze Rule

13.3.3.1 Results

The estimated benefits and costs associated with achieving a .67 and 1 deciview visibility improvement, incremental to the application of controls to attain the PM_{2.5} 15/65 standard, are presented in Table 13.3.

13.3.3.2 Key Results and Conclusions

- Net monetized benefit estimates are ambiguous for both RH alternatives assessed.
- Actual benefits and costs associated with the proposed RH rule will depend on the reasonable progress target levels included in State Implementation Plans (see Chapter 8).

**Table 13-3 Comparison of Annual Monetized Benefits and Costs of
RH Alternatives in 2010
(1990\$)**

RH Alternative Incremental to PM_{2.5} 15/65	Annual Benefits (billion \$) (A)	Annual Costs (billion \$) (B)	Net Benefits (billion \$) (A - B)	Residual Noncompliant Class I Areas
1.0 Deciview Improvement Over 15 Year (0.67 Deciview Target)	1.3 - 3.2	2.1	(0.8) - 1.1	17
1.0 Deciview Improvement Over 10 Years (1.0 Deciview Target)	1.7 - 5.7	2.7	(1.0) - 3.0	28

NOTE: The benefits range results are associated with the RH targets and are directly linked to the eventual choices made by States on the reasonable progress targets for the period 2000 to 2010. Should the States submit approvable State implementation plans (SIPs) with reasonable progress target levels set close to those that would be achieved by implementation of the NAAQS and other CAA requirements, then visibility improvements and benefits attributed to the RH program will be minimal and could be as low as zero.

13.4 LIMITATIONS TO THE BENEFIT-COST COMPARISONS

As discussed throughout this document, there are significant analytical uncertainties associated with these benefit-cost assessments. Various emission inventory, air quality modeling, cost, health and welfare effect, and valuation uncertainties and limitations are discussed throughout this analysis. An effort has been made to account for some of these uncertainties through the estimation of a plausible range of monetized benefits as described in chapter 12. Additional limitations specific to the comparison of estimated benefits and costs for the various alternatives include the following:

- Some identified benefit categories associated with PM and ozone reductions could not be quantified or monetized. Nonmonetized benefit categories include changes in pulmonary function, altered host defense mechanisms, and cancer. Thus, this chapter presents a comparison of estimated *monetized* benefits versus estimated total costs.

- The uncertainty associated with the benefit estimates may be greater than the uncertainty associated with the P/A cost estimates. In particular, benefit estimates vary greatly depending on the mortality risk reduction effect and valuation measures employed.
- Full-attainment cost estimates are speculative and should be compared with full-attainment benefit estimates with caution.
- Comparisons of P/A costs and benefits across alternatives examined should be made with caution because of the existence of residual nonattainment (RNA). P/A costs associated with more stringent standards may not increase at an increasing rate because the additional violating counties may have low-cost controls available to attain the more stringent standards. The number of RNA areas, however, increases with the stringency of the standards.
- The cost and benefit estimates presented in this chapter do not account for market reactions to the implementation of these rules. These estimates represent the direct but not the true social benefits and costs (calculated after market adjustments to price and output changes, etc.) associated with alternative standards. Social costs are typically somewhat smaller than direct control costs while social benefits may be greater or less than direct benefits depending on the specific market adjustments and substitutions that occur.

13.5 SUMMARY

Despite numerous limitations and uncertainties, the analysis provided in this document provides a basis for believing that in the reference year 2010 benefits resulting from efforts to meet both new NAAQS are likely to exceed costs. Though uncertainties associated with estimates after the next decade trend toward lower costs, it is not clear today what those out-year costs will be. The history of compliance with the Clean Air Act indicates, however, that a commitment to continue progress today does not require rigid adherence to timelines that, in ten or more years, prove to be impractical.