

October 29, 1999

EPA-SAB-COUNCIL-ADV-00-002

Honorable Carol M. Browner
Administrator
U.S. Environmental Protection Agency
401 M Street, SW
Washington, DC 20460

RE: The Clean Air Act Amendments (CAAA) Section 812 Prospective Study
of Costs and Benefits (1999): Advisory by the Advisory Council on Clean
Air Compliance Analysis: Costs and Benefits of the CAAA

Dear Ms. Browner:

On July 13-14, 1999, the Advisory Council on Clean Air Compliance Analysis (Council) met to provide advice on nine charge questions relating to the costs and benefits associated with implementation of the 1990 Clean Air Act Amendments (CAAA of 1990, Section 812, Public Law 101-549, November 15, 1990, 104 Stat. 2399). At the meeting, the Council discussed the Agency's draft assessment of the benefits associated with a projected reduction in air emissions, as reviewed by the Council's Air Quality Modeling Subcommittee (AQMS) as presented in the draft Agency document, *The Benefits and Costs of the Clean Air Act, 1990 to 2010; EPA Report to Congress* (U.S. EPA, Office of Air and Radiation and Office of Policy, June 1999). To assess these benefits, the Council also considered the health and ecological effects of implementation of the CAAA, again as described in the draft study and as reviewed by the Council's Health and Ecological Effects Subcommittee (HEES). The Council also reviewed the Agency's draft assessment of the costs associated with implementation of the amendments.

The Council recognizes the significant amount of money and time the Agency has invested in the 812 Prospective Study and commends EPA for its efforts. While the study contains a reasonable representation of the standard literature on estimating costs and benefits, it is hampered by scientific uncertainties. These gaps in our knowledge – in air quality modeling, measurement of health and ecological endpoints, and valuation of reduced mortality and chronic lung disease – limit the usefulness of the study as a guide to policy and will hamper future studies unless research is undertaken to reduce these uncertainties. To prioritize research needs we

recommend that a value of information analysis be conducted to identify where the benefits from additional research are greatest.

The first knowledge gap concerns emissions inventories and air quality modeling. The problems here are three-fold. There are inconsistencies between emission inventories and observed air quality that almost certainly reflect biases in the emission inventories. For example, the fraction of fine particles attributable to motor vehicles in the emission inventory appears to be too low, which may cause the benefits of reducing vehicle emissions to be understated. Second, there are problems of inferring air quality in areas where monitors do not exist. Finally, there are limitations in the air quality models that link emissions to ambient air quality. The Council strongly seconds the recommendation of the AQMS that a panel be appointed to help develop better emissions inventories for the criteria pollutants. It also agrees with the AQMS that the use of a more sophisticated air quality modeling platform for the entire United States, such as Models 3, would improve analyses of many air quality regulations.

In the area of health and ecological effects of air pollution our main knowledge gaps concern: (1) the health effects of toxic air pollutants; (2) the ecological effects of the criteria pollutants; and (3) the impact of the criteria pollutants.

The Council is also very concerned that the values used to monetize health and ecological effects are in some cases weak surrogates for the real values. This is especially true of the values assigned to reductions in premature mortality, which we believe are likely to be biased upward. In addition to overstating the value of mortality benefits, this has the effect of putting more emphasis on mortality benefits relative to morbidity and ecological benefits. We believe that the solution is to fund research to produce appropriate willingness to pay (WTP) values for both avoided mortality and avoided morbidity. We draw special attention to the need for additional studies of WTP to reduce chronic bronchitis risk, even though we agree that the Agency is using the best estimates available

Overall, we believe that the gaps in knowledge need to be reflected by an enhanced treatment of uncertainty. EPA has relied on Monte Carlo analyses that express very limited forms of uncertainty. We recommend that this report and future reports be enhanced by communicating more clearly the large “model” uncertainties at every stage of the analysis.

In this Advisory, the Council will summarize the key findings of its two subcommittees, answer each of the nine charge questions in turn, and, in the context of those charge questions, address several over-arching issues.

Summary of Key Points in the AQMS and HEES Letter Advisories

The AQMS commends the study team on the progress made since the last review.¹ The outstanding limitations (particularly those associated with the estimates of directly emitted fine and coarse particulate matter (PM) and the air quality simulations of secondary PM), if captured in concise discussions and tables, should strengthen the acceptability of the overall report. The Subcommittee also wants to emphasize that future Prospective Studies could benefit greatly from our recommended Agency-wide analysis of representativeness and reliability of emissions modeling, use of the same, high quality air quality modeling system platform (such as Models-3) across the entire United States, and further exploration of a wider range of techniques for dealing with uncertainties in complex assessments. The AQMS is ready to help support the emissions review and reconciliation of emissions inventories and modeling results with observations. This issue cuts across many activities of the Agency and deserves careful consideration.

The HEES also commends the Agency for its efforts in developing the first Prospective Study.² In fact, it has been an enlightening exercise which demonstrates the deficiencies in data and models used to define exposure and health endpoints for human and ecological systems. Research needs for future Section 812 Studies need to be seriously considered by the Administrator and the Office of Research and Development. Targeted studies need to be developed and executed cooperatively by the Agency and researchers in the appropriate fields of ecology, exposure, and health effects. The HEES sees the need to strengthen the knowledge base to understand the human health effects from exposure to particulate matter and hazardous air pollutants, and the ecosystem effects relating to air emissions.

With regard to hazardous air pollutants (HAPS), it has been difficult to quantify physical impacts because of lack of monitoring data, poor performance of the ASPEN (Assessment System for Population Exposure Nationwide) exposure model, and the use of EPA's standard unit risk factors for the best estimate of risk. To begin the process of directing the agency to develop new methods for characterization of hazards and exposure, and to acquire monitoring data on HAPS that can assist the 812 process for the next subsequent Prospective Study, the HEES has recommended holding an SAB-sponsored Workshop. The charge to the Workshop is: *To provide the EPA with specific recommendations for developing and validating monitoring, modeling and assessment data to yield best estimates of realistic risks to HAPS for the purposes of conducting Section 812 prospective Cost Benefit analyses.* While the Workshop focus will be

¹ See AQMS Letter Advisory, "The Clean Air Act Amendments (CAAA) Section 812 Prospective Study of Costs and Benefits (1999): Advisory by the Air Quality Models Subcommittee on Modeling and Emissions," EPA-SAB-COUNCIL-ADV-99-013.

² See HEES Letter Advisories, "The Clean Air Act Amendments (CAAA) Section 812 Prospective Study of Costs and Benefits (1999): Advisory by the Health and Ecological Effects Subcommittee on Initial Assessments of Health and Ecological Effects, Part 1", EPA-SAB-COUNCIL-ADV-99-012 and "Part 2", EPA-SAB-COUNCIL-ADV-00-001.

on human risks, it should be viewed as one first step in the process that will also consider the Section 812 needs for ecological risks from HAPS. The foundation of the workshop would be Agency implementation of the HEES recommendation to conduct case studies of two or three selected HAPS that would attempt to cover the complete range of Section 812 analyses.

Response to Charge Questions

Background on Major Charge Questions (Charge Questions 1, 2, and 3)

The first three charge questions are major ones concerning the strength of the Agency's assessments of costs and benefits and the comparison of those costs and benefits. Those major charge questions rephrase the review responsibilities of the Council as defined in section 812 of the CAAA. They are:

Charge #1: Are the input data used for each component of the analysis sufficiently valid and reliable for the intended analytical purpose? If not, does the Council recommend the Agency consider using alternative data or assumptions for the first prospective analysis?

Charge #2: Are the models, and the methodologies they employ, used for each component of the analysis sufficiently valid and reliable for the intended analytical purpose? If not, does the Council recommend the Agency consider using alternative models or methodologies for the first prospective analysis?

Charge #3: Are the analytical results developed using these data and methodologies sufficiently valid and reliable for the intended analytical purpose, and are the characterizations of the analytical methods and results sufficiently accurate and appropriate for the intended expository purpose?

We shall answer these questions separately for three distinct topics: the measurement of benefits, the measurement of costs and the comparison of benefits and costs.

Benefits Related to Health and Ecological Effects (Charge Questions 1, 2, and 3)

The Council finds the Agency's methodology for valuing health benefits generally acceptable (Charge Question #2). This includes the choice of dose-response functions to quantify health effects, and the principle of using of individual WTP estimates to value those health effects.

One case in which we question the validity of the dose response function is in the analysis of Title VI. Most of the benefits of Title VI (and one quarter of the total benefits of the CAAA) come from reductions in melanoma deaths by preventing the depletion of stratospheric ozone.

While there is consensus on the dose-response relationship between cataracts and nonmelanoma skin cancers and exposure to ultraviolet light, there is less certainty as to whether melanoma is caused by ultraviolet light. Thus, the report should discuss more fully the evidence supporting the dose-response function used. Even more doubtful is the failure of the study to account for (1) potential advances in medical knowledge in detecting and treating melanomas over the next century and a half and (2) defensive behavior that would reduce exposure to ultraviolet light. For example, Australia has waged a successful campaign to reduce the incidence of skin cancers and to detect melanomas at an early stage where they can be cured. The estimated benefits from Title VI are less certain than the report indicates and almost certainly much lower than the reported estimates. Neither the Council nor the HEES reviewed the underlying modeling from the Regulatory Impact Analysis (RIA) on predicting changes in ultra-violet b radiation (UV-b) at the earth's surface as a function of changes in stratospheric ozone.

In valuing the benefits of reduced mortality, especially from reductions in the criteria pollutants, the Council believes that the input data used by the Agency have limitations (Charge Question #1) and that the limitations of the current estimates are not discussed in sufficient detail in the text of the June draft (Charge Question #3).

The value of premature deaths avoided constitutes the single largest category of benefits in the first Prospective Study. Following earlier advice from the Council, the Agency has valued the statistical lives saved by the CAAA in two ways—using a value per statistical life saved (VSL) of \$4.8 million (1990 dollars), and using a value per statistical life-year saved of \$293,000 (1990 dollars). Although the Council advised the Agency to use these numbers, we believe that both have severe limitations. The first number is the mean VSL based on 26 studies identified during the Retrospective Study. We are troubled by the fact that the populations in the 26 studies are not a good match for the population whose lives are extended by the CAAA. As the Prospective Study notes, the mean remaining life expectancy of persons whose lives are extended by the CAAA is 14 years. It is 35 years in the 26 studies. The use of a value per statistical life-year saved is an attempt to adjust for this fact, but it is a crude one. A better approach would be to estimate the WTP of people of all ages for the increase in the probability of surviving to all future ages that the shift in the survival curve represents.

The Council finds that the discussions of options for valuing mortality risk reductions in Chapter 7 and in Appendix H do not adequately convey the uncertainty over the estimation of this critical variable. The Council suggests that Chapter 7 be expanded first to consider in greater detail the commodity to be valued when one draws upon the Pope et al. study for the physical

effects estimate.³ The Council feels that these physical effects should be expressed both in terms of the number of statistical lives saved annually (broken down by age), and in terms of shifts in the survival function of each person in the exposed population. The former approach is what is currently used in the study; the latter cannot yet be used because there are no empirical estimates of what people will pay for a shift in their survival functions.

Second, EPA should evaluate the pros and cons of alternative approaches to measuring the benefits of these physical changes. The economics literature contains a variety of alternative approaches, which might collectively be characterized as the social willingness to pay to prevent a statistical premature death. These approaches would include the labor market and accidental death contingent valuation method (CVM) studies, the Viscusi exponential discounting approach, the life expectancy approach detailed in the Canadian study "Health and Environmental Impact Assessment Panel Report for the Joint Industry/Government Study; Sulphur in Gasoline and Diesel Fuels," (June 25, 1997, Sponsor: Health Canada), and modifications suggested by Krupnick, Cropper, et al., in their paper published in EPA's Health Valuation Workshop, March, 1999.⁴ The EPA is encouraged to provide quantitative estimates to compare these approaches wherever possible.

Another way to emphasize that the current VSL measures are inappropriate is to calculate the cost per statistical life and per statistical life-year saved of the CAAA. We suggest that this be presented in a separate box and discussed in the text of the Prospective Study. This could be done for the year 2010 by subtracting the monetized value of other benefits from costs and dividing the result by the number of lives or life-years saved. This approach avoids VSL measures altogether, which is appropriate if existing valuation estimates are inadequate. Instead, it gives an upper bound estimate of the cost per life (or life-year) saved. This is a standard method for evaluating life-saving programs in the public health literature.

With regard to measuring and valuing ecological effects, the Council generally agrees with the methods employed, but believes that the "displaced cost" approach to valuing reductions in pollution must be used with caution. The study suggests that reduced nitrogen oxide (NO_x) emissions under the CAAA, by leading to reduced nitrate loads in estuaries, make unnecessary some measures that would have been taken by state and local governments to reduce nitrates. The

³ Pope, C.A. III; Thun, M.J.; Namboodiri, M.; Dockery, D.W.; Evans, J.S.; Speizer, F.E., and Heath, C.W., Jr. Particulate Air Pollution is a Predictor of Mortality in a Prospective Study of U.S. Adults. *Am. J. Respir. Care Med.*, Vol. 151, March 1995, pp. 669-674.

⁴ Krupnick, A., Alberini, A., Cropper, M., Simon, N., Itaoka, K., and Akai, M., "Mortality Risk for Environmental Policy," in U.S. EPA, *Valuing Health for Environmental Policy with Special Emphasis on Children's Health Protection, Proceedings of the Second Workshop in the Environmental Policy and Economics Workshop Series*, March 24, 1999, Washington, DC.

cost of these avoided measures is taken to be the benefit of the reductions in nitrate loadings produced by the CAAA.

The displaced cost approach is valid if state and local governments have established firm pollution reduction targets and if the displaced costs, as measured in the study, are the cost of the measures not taken because of the CAAA. The Council is concerned that the nitrate reduction targets in the estuaries studied are not firm targets, as they are, for instance, in the sulfur dioxide (SO₂) trading system. There is thus no assurance that the planned measures would be undertaken in the absence of the CAAA. For instance, the Chesapeake Bay compact calls for a 40% reduction in loadings. The baseline, however, is unclear, there is no enforcement mechanism, and one could make the argument that the 40% reduction is aspirational. Second, there is no reason to believe that the most socially costly measures will be the ones avoided, as the study currently assumes. Political concerns, government subsidies, or bureaucratic inertia could all lead to other measures being avoided -- or none at all.

For these reasons the Council does not endorse EPA's use of these estimates as part of its "primary" benefit estimates for the Chesapeake Bay or any other estuaries unless and until hard caps are in place. Should there be a table or section of a table with "secondary" or "nontraditional" benefit and cost estimates included in chapter 8, these displaced cost estimates could be included there. The Council does not endorse the use of these particular costs, even as secondary costs, as surrogates for NO_x reductions unless they bound the avoided cost of all measures for nitrate load reductions, not just the uncertainty bounds around the most expensive measures.

Costs (Charge Questions 1, 2, and 3)

With regard to Charge Question 1, the Council believes that the data used to compute costs appear to be generally acceptable. It was not feasible to review all of the input data used in computing direct costs. A good deal of the data are drawn from RIAs, which presumably have undergone review; we assume such data to be reasonably reliable. The low emission vehicle (LEV) costs are taken from the California Air Resources Board and are acknowledged in the report to be low. We recommend that the Agency reexamine these costs because the Board has new information on LEV costs. In particular, the lower and upper values for uncertainty analysis should span common estimates of costs.

With regard to Charge Question 2, the report compares three approaches (direct compliance costs, partial equilibrium modeling, and general equilibrium modeling), but it does not give a good sense of the likely differences among these approaches. Is the use of the direct cost method likely to overstate or understate the costs derived from each of the other methods? The

appendix states that the estimate of direct cost in the retrospective study (\$523 billion) was in the range found by the “macro” model (\$493 to \$621 billion), but these studies have so many differences that the numbers are not comparable at all. Does “macro” model mean general equilibrium model? Did that model include tax interaction effects? What *conceptually* are the differences between direct cost and social cost?

With regard to direct costs, models used to compute costs appear to be generally reliable. It is, however, difficult to judge the reliability of the models, given the information provided in the report. The two primary models, the Emission Reduction and Cost Analysis Model (ERCAM) and the Integrated Planning Model (IPM), should be briefly described in the appendix so that the reader has a better idea of the models' structural approach to estimating costs. An indication of what validation the models have undergone would also be useful. In the case of LEV's, the question of whether very low sulfur fuel is needed should be examined. The models report direct costs. The report should define more clearly what is included in direct costs; control equipment? monitoring? permitting? Along these lines, are the costs associated with product quality degradation from environmental regulations included? For instance, if a chain saw becomes substantially heavier due to controls, its performance is degraded and that is a cost not reflected in the direct costs of the equipment add-on.

In regard to Charge Questions 3, the results of the analysis appear to be reasonable, given the caveats articulated in the context of Charges 1 and 2.

Comparison of Benefits and Costs

Characterization of Uncertainty. The report takes an important step forward by modeling uncertainty explicitly via probability density functions (pdf). The method allows EPA to report on a confidence interval for the "bottom line" and other results that result from two or more factors which are uncertain. It is inherently difficult and necessarily subjective to characterize these uncertainty distributions and the pdf. EPA should not be deterred by the criticism that will result. However, EPA must take care that the pdf reflect more than the statistical measures of uncertainty from the estimation. Insofar as possible, all sources of uncertainty should be included.

A still more important source of uncertainty is the qualitative issue of whether something is true or not. For example, does UVb radiation cause melanoma? Is it PM2.5 or some other pollutant that causes premature mortality? The report should treat these questions as conditional or contingent benefit estimates. "Assuming that UVb causes melanoma, the benefits are \$x; assuming that UVb does not cause melanoma, the benefits are \$y." These conditional statements isolate qualitative sources of uncertainty.

Table 8-3 indicates some of the uncertainty about the benefit estimates, using a Monte Carlo approach that takes advantage of the fact that many of the parameters estimated in the literature also have estimated variances. Using those variances, the benefit cost ratio at the 5th percentile is 1/1, at the mean is 6/1, and at the 95th percentile is 13/1.

Yet those bounds understate the true degree of uncertainty, because many other parameters employed in the report do not have estimated variances. They are treated as if they were certain, since confidence intervals are not available, and yet these same parameters have considerable uncertainty about them. The report undertakes sensitivity analysis around some of these parameter values, but these bounds do not enter the Monte Carlo analysis.

In particular, Table 8-3 indicates no uncertainty whatsoever about the estimates of costs. Yet clearly those costs are not certain. If some reasonable bounds were placed on the cost estimates, then the benefit/cost ratio at the lower end would fall below 1/1. The Council notes that the 95% upper limit could also be higher.

We recommend using some method to indicate more uncertainty in Table 8-3. If analysts can choose reasonable 5th percentile and 95th percentile values for many of these specified parameters, then that uncertainty can be entered into the Monte Carlo analysis. If not, then the limited uncertainty analysis in Table 8-3 should be removed from that table, so that all sources of uncertainty can be considered in a different table. Table 8-3 should not continue to show limited sources of uncertainty, as it does in the draft report, because it misleadingly understates the true degree of uncertainty.

Disaggregation. Table 8-3 (on page 8-7 of the draft report) represents the bottom line of the entire study, and it shows the results that will be most often quoted. At the mean estimate, benefits exceed costs of the Clean Air Act Amendments by a ratio of six to one. But that single overall aggregate ratio has little practical relevance, since nobody is considering wholesale repeal of the CAAA. Instead, the point of this analysis must be how to change the law to improve it. What provisions are working most successfully, and which are not? In what ways can those provisions be improved? The only way to address such questions is to disaggregate. The report needs to provide both costs and benefits on some comparable basis, such as by title, and preferably provision by provision.

The Council has asked for such disaggregation before, and it has not yet been provided. Those undertaking the study for the EPA may not have adequate resources or the analytical tools available to undertake all of the necessary additional steps to provide such estimates. Given the advances in the methods and information developed for the current Prospective Study and availability of a universal platform for modeling emissions, such as Models-3, the Council will not

find the analyses in future prospective studies valid and reliable for their intended analytical purpose without significant disaggregation by title and provision.

Unquantified/Unmonetized Benefits and Disbenefit Categories (Charge Question 4)

Charge Question 4a: Does the Council endorse the recommendations of HEES members that EPA strive to provide estimates of changes in some additional health and welfare effects in order to provide information on the potential relative importance of currently unquantified or unmonetized endpoints?

Response: Yes. This is consistent with the original Congressional mandate.

Charge Question 4b: Does the Council concur with the simplistic approaches for providing screening-level estimates proposed by EPA for each endpoint and for inclusion of these calculations in the 812 report as illustrative calculations presented in an appendix?

Response: The simplistic approaches to quantification and valuation may be appropriate for screening level estimates. However, it is still necessary that there be a sound scientific basis for such estimates. The Council is concerned that the list of unquantified and unmonetized benefits presented in Table 1 of the Attachment to James DeMocker's memorandum of June 10, 1999 along with citations to the relevant literature have not been presented to HEES for review. Thus inclusion of these estimates in the First Prospective Study, even as screening estimates, is premature. The Council encourages the Agency to pursue the items on this list and to seek the advice of HEES early in the development of the Second Prospective Study. However, we also note that there is potential for double counting of benefits since some of the unquantified health effects in this list may also manifest themselves in the estimates of other endpoints that are quantified in this Report and that some of the effects on this list are of uncertain welfare significance (e.g., changes in airway responsiveness).

We are also unable to evaluate most of the "Screening-level Benefits Calculations" in Table 2 of this memo since we were not given adequate time and documentation of the calculations and references. Again, we encourage the Agency to pursue these early in the development of the Second Prospective Study.

Charge Question 4c: Does the Council have specific suggestions for additional benefit or disbenefit categories not listed by EPA? If so, does the Council have specific suggestions for methods for developing screening level estimates of these categories?

Response: We have no specific suggestions.

Value of Avoided Chronic Bronchitis (Charge Question 5)

Charge Question 5a: Does the Council concur with EPA's proposed continued use of the adjusted WTP value from Viscusi et al. -- i.e. \$320,000 per incidence (1997\$)-- to support the primary benefit estimate?

Response: The Council concurs with EPA's continuing use of the adjusted willingness to pay (WTP) value from Viscusi et al.⁵ for chronic bronchitis for the following reasons:

1. Appropriate adjustments have been made to transfer the original benefit estimate of WTP for more severe pulmonary disease to the onset of less severe cases of chronic bronchitis associated with exposure to fine particles.

2. While the Viscusi et al. study is the basis for the specific value used, it is not the only study to report that WTP to avoid chronic pulmonary disease is substantial.

3. Criticisms of the Viscusi et al. study have been recognized and addressed by EPA staff and contractors. Further, criticisms that might apply to the application of any CV study to *post hoc* compensation assessments are not as relevant to the use of a CV study in assessing the benefits of *ex ante* actions that reduce the frequency of adverse health effects.

Charge Question 5b: If the Council does not concur with EPA's proposed use of the Viscusi, et al. value in the primary estimate, does the Council recommend using an unadjusted value based on the cost-of-illness method, or is an adjustment based on empirical evidence relating cost of illness (COI) to WTP appropriate?

Response: The question is not applicable because we concur with the use of Viscusi et al.

Charge Question 5c: If the Council does not concur with EPA's proposed use of the Viscusi, et al. value to determine the primary benefit estimate, does the Council recommend using the Viscusi et al. value in a sensitivity analysis to illustrate potential differences between COI and WTP?

Response: The question is not applicable because we concur with the use of Viscusi et al.

Value of Avoided Visibility Degradation (Charge Question 6)

⁵ Viscusi, W.K., W.A. Magat, and Huber, J., "Pricing Environmental Health Risks: Survey Assessments of Risk-Risk and Risk-dollar Tradeoffs," *Journal of Environmental Economics and Management*, 1991, 201, pp. 32-57.

Charge Question 6a: Does the Council concur with EPA's proposed use of the WTP value from McClelland et al. (1993) -- i.e., \$17 per household per deciview improvement (1997\$)-- to support the primary benefit estimate? If not, should EPA treat residential/urban visibility improvements as a screening level benefit category to be reported in an appendix, or does the Council have a specific recommendation for an alternative estimate of the value for this endpoint?

Response: The Council advises the Agency to place the values in a screening level benefit category. The McClelland et al. study was an exploratory study so the values found in it lack peer reviewed status. The authors, since 1990, have reduced their values by 50% to address the "warm glow" effect found in similar studies and would reduce these quoted values by 50 percent presently to account for "warm glow."⁶ They would not treat non-responses now as they did then, and this reduces the cited values by 20 percent. These two adjustments reduce the value to about \$7.25 from \$17. With the authors wanting to make these sorts of revisions, the Council believes that it is inappropriate to use their study values.

Charge Question 6b: Does the Council concur with EPA's proposed use of the WTP values from Chestnut and Rowe (1990) --i.e. \$4.91 to \$13.51 per household per deciview improvement (1997\$) for households living outside of the region where a Class I area is located and \$7.98 to \$16.82 per household per deciview improvement (1997\$) for households living in the region where a Class I area is located-- to support the primary benefit estimate? If not, should EPA treat Class I area visibility improvements as a screening level benefit category to be reported in an appendix, or does the Council have a specific recommendation for an alternative estimate of the value for this endpoint?

Response: The Council believes that EPA should rely on the peer-reviewed literature as the basis for its regulatory analyses. Although many members of the Council believe that the Chestnut and Rowe study is the best available,⁷ we believe that the general principle should be adhered to. It would, however, be appropriate to discuss the Chestnut and Rowe results, putting them in a "secondary" benefit category.

Value of Avoided Premature Mortality (Charge Question 7)

Charge Question 7a: Does the Council concur with EPA's proposal to continue using the Weibull distribution as the most appropriate distribution to characterize the variability in the 26

⁶ Personal communication to Gardner Brown, 7/12/99.

⁷ Chestnut, L.G. and R.D. Rowe. 1990. "Preservation Values for Visibility Protection at the National Parks," Cooperative Agreement #CR-813-686, U.S. Environmental Protection Agency: Research Triangle, North Carolina.

VSL estimates? If not, does the Council have a specific recommendation for an appropriate distribution of these values?

Response: The Council concurs with EPA's proposal to continue using the Weibull distribution to characterize variability in the 26 VSL estimates.

Charge Question 7b: Does the Council concur with EPA's proposed use of the arithmetic mean as the appropriate point estimate for the VSL? If not, does the Council have a specific recommendation for an appropriate alternative point estimate?

Response: The Council concurs with EPA's proposal to use the arithmetic mean of the 26 studies (as opposed to the geometric mean).

Charge Question 7c: Does the Council concur with EPA's proposal to continue using 5 percent as the appropriate discount rate for estimating the value of an avoided mortality incidence using the statistical life-years method? If not, does the Council have a specific recommendation for the appropriate discount rate?

Response: The Council concurs with EPA's choice of 5 percent as the appropriate discount rate to use in computing the value of a statistical life-year.

Charge Question 7d: Does the Council concur with EPA's proposal to (1) continue using an estimate of 14 years as the appropriate number of life-years saved when age specific distributions of avoided premature mortality incidences are not available and (2) continue using age-specific numbers of life-years when age specific distributions of avoided premature mortality incidences are available?

Response: The Council concurs with EPA's proposals. The Council regards the 14 years of additional life expectancy as a highly uncertain estimate. We have no alternative number to suggest but urge EPA to investigate this estimate thoroughly since it is a critical justification for the dollar benefits of lowering premature mortality.

Tax Interaction Effects (Charge Question 8).

Charge Question 8: Does the Council consider the scope and content of the Appendix B text on tax interaction effects valid and appropriate given the intended purpose of the 812 Prospective? If not, does the Council have specific recommendations for revisions to the scope and/or substance of the draft report language?

Response: The Council believes that the tax interaction effects of the CAAA do not receive sufficient discussion in the text of the Prospective Study. Attempts to dismiss these costs of environmental regulation should be removed from the text and from Appendix B. The Council believes that environmental policy should be held accountable for any tax interaction effect.

Tax interaction effects occur when environmental regulations exacerbate (or ameliorate) the distortions in labor and capital markets caused by income and profit taxes. Because the labor income tax lowers the after-tax wage, it drives a wedge between people's productivity (their wage) and what they receive. This causes them to supply less labor than they would in a world without taxes, and results in a loss of output (an efficiency loss). If environmental regulation raises the prices of goods and services, it implicitly lowers the real wage. This exacerbates the efficiency loss caused by labor income taxes.

Studies have estimated that the cost of this tax interaction effect is 1.25 to 1.35 times any increase in direct cost. Even "small" regulations raise prices, reduce the real net wage, and add to the deadweight loss caused by labor taxes. Similar effects arise in capital markets, with pre-existing capital income taxes. The report points to the possibility of using market instruments (such as permits or taxes). It is true that these policies might have lower costs than regulations, but this point has nothing to do with tax interaction effects. Any such policy raises production costs, reduces the real net wage, and exacerbates labor tax distortions.

The report indicates that environmental policy should not be held accountable for costs due to interactions with the tax system. This point lacks justification. It is appropriate for the report to indicate the costs imposed by environmental policy, given the existing tax system. Although the costs of environmental policy could indeed differ if the tax system were different, the valid approach is to consider the costs under existing conditions for the tax system (and for other institutional aspects of society as well). Most importantly, the report should not appear to claim that tax interaction effects should be ignored because accounting for them could "effectively result in reduced environmental controls." This seems tantamount to throwing out valid data because one does not like what it implies.

Income Adjustments to Willingness to Pay (Charge Question 9)

Charge Question 9: Does the Council concur with the specification of the sensitivity analysis examining income adjustment to WTP currently incorporated in the draft report, and with EPA's specific proposal to include this sensitivity analysis in Appendix H of the first prospective analysis? If not, does the Council have specific recommendations for revisions to the specification of the sensitivity analysis and/or recommendations regarding the merits of incorporating any analysis and discussion of income adjustments to WTP in the first prospective analysis?

Response: The Council accepts the sensitivity analyses of unit values for health endpoints based on alternative assumptions about the income elasticity of willingness to pay. The empirical basis for making such estimates is relatively limited, with the majority of estimates coming from contingent valuation and related hypothetical methods for valuation. However the Agency has identified the relevant literature and used appropriate methods to make these adjustments.

Conclusion

Subject to the above caveats, we believe that the Agency has produced credible estimates of the benefits and costs of the 1990 Clean Air Act Amendments, given the state of current knowledge. We recognize the difficulty of the task, and wish to congratulate EPA on the efforts taken to complete the Study under significant time and resource constraints. We thank the Agency for the opportunity to review the forthcoming Prospective Study and to make recommendations to improve the methods and data to be used in future prospective studies. We look forward to your response to this Advisory.

Sincerely,

/signed/

Dr. Maureen L. Cropper, Chair
Advisory Council on Clean Air Compliance
Analysis
Science Advisory Board

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