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**MEMORANDUM | February 23, 2010**

**TO** Jim DeMocker, EPA/OPAR

**FROM** Tyra Walsh and Jim Neumann, Industrial Economics (IEc)

**SUBJECT** Proposed Changes to Qualitative Uncertainty Table Structure

## INTRODUCTION

Based on comments provided by the Science Advisory Board (SAB) Health Effects Subcommittee (HES) during a meeting on December 15 & 16th, 2009, we have developed an alternative qualitative presentation of uncertainties associated with the net benefits estimates in the 812 Second Prospective Report. In particular, the HES indicated that it would be useful to include an assessment of the Project Team's confidence in the assumptions included in these tables in addition to the assessment of the impact of an alternate assumption on the net benefits estimate.

The table below represents our proposed revision to the qualitative uncertainty tables contained in Appendix C of the *Uncertainty Analyses to Support the Second Section 812 Benefit-Cost Analysis of the Clean Air Act* report provided to the panel. This table includes a subset of the uncertainties related to the health benefits analysis as an example.

The first column provides a brief description of each key assumption made in the Second 812 Prospective analysis. The second column indicates the direction of the potential bias with respect to the overall net benefits estimate. The third indicates the magnitude of the impact of the potential bias on the net benefits. The Project Team assigns a classification of "potentially major" if a plausible alternative assumption or approach could influence the overall monetary benefit estimate by approximately five percent or more. If an alternative assumption or approach is likely to change the total benefit estimate by less than five percent, the Project Team assigns a classification of "probably minor."[1] This assessment is intended to provide readers with a sense for the quantitative impact on the net benefits estimate if an alternate assumption to that selected by the Project Team were to be implemented. Finally, the fourth column provides our level of confidence in the selected assumption, based on our assessment of the available body of evidence. That is, based on the given available evidence, how certain we are that the selected assumption is the most plausible of the alternatives. The Project Team uses the following four qualitative categories to express the degree of confidence in the chosen assumption:

- "High" – the current evidence is plentiful and strongly supports the selected assumption;

[1] If the quantitative magnitude of the assumption's effect on the net benefits cannot be assessed, the Project Team indicates that this is "Unknown."

- "Medium" – some evidence exists to support the assumption, but data gaps are present; and
- "Low" – there are limited data to support the selected assumption.
- The Project Team uses "N/A" to indicate that the data was so limited that it was excluded from the analysis entirely.

| POTENTIAL SOURCE OF ERROR | DIRECTION OF POTENTIAL BIAS FOR NET BENEFITS ESTIMATE | MAGNITUDE OF IMPACT ON NET BENFITS ESTIMATE | DEGREE OF CONFIDENCE |
|---|---|---|---|
| Analysis assumes a causal relationship between PM exposure and premature mortality based on strong epidemiological evidence of a PM/mortality association. However, epidemiological evidence alone cannot establish this causal link. | Overestimate | Potentially major. PM/mortality effects are the largest contributor to the net benefits estimate. If the PM/mortality relationship is not causal, it would lead to a significant overestimation of net benefits. | High. The assumption of causality is suggested by the epidemiologic and toxicological evidence and is consistent with current practice in the development of a best estimate of air pollution-related health benefits. At this time, we can identify no basis to support a conclusion that such an assumption results in a known or suspected overestimation bias. |

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|---|---|---|---|
| Application of C-R relationships only to those subpopulations matching the original study population. | Underestimate | Potentially minor. The C-R functions for several health endpoints (including PM-related premature mortality) were applied only to subgroups of the U.S. population (e.g. adults 30+) and thus may underestimate the whole population benefits of reductions in pollutant exposures. However, the background incidence rates for these age groups are likely low and therefore would not contribute many additional cases. | High. The baseline mortality and morbidity rates for PM-related health effects are significantly lower in those under the age of 30. |
| It is possible that the PM/mortality relationship is modified by socioeconomic status (SES). The Pope et al. epidemiological study selected to estimate PM-related mortality does not take this potential effect modification into account. | Underestimate | Potentially major. The demographics of the study population in the Pope et al. study (largely white, middle class, and high educational attainment) may result in an underestimate of PM-related mortality, because the effects of PM tend to be significantly greater among groups of lower SES. | Medium. Studies have found effect modification of the PM/mortality effect by SES, as assessed through education attainment (Krewski et al., 2000). However, this effect is likely to affect only the Pope et al. estimate. Our inclusion of both the Pope et al. and Laden et al. (which does includes a more diverse population) helps account for the possibility of this uncertainty. |

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|---|---|---|---|
| The baseline incidence estimate of chronic bronchitis based on Abbey et al. (1995) excluded 47 percent of the cases reported in that study because those reported "cases" experienced a reversal of symptoms during the study period. These "reversals" may constitute acute bronchitis cases that are not included in the acute bronchitis analysis (based on Dockery et al. 1996). | Underestimate | Potentially minor. The relative contribution of acute bronchitis cases to the overall benefits estimate is small compared to other health benefits such as avoided mortality and avoided chronic bronchitis. | Low. The exclusion of roughly half of the potential cases results in a highly uncertain estimate of baseline acute bronchitis incidence. |
| CAAA fugitive dust controls implemented in PM non-attainment areas would reduce lead exposures by reducing the re-entrainment of lead particles emitted prior to 1990. This analysis does not estimate these benefits. | Underestimate | Potentially minor. The health and economic benefits of reducing lead exposure can be substantial (e.g., see section 812 Retrospective Study Report to Congress). However, most additional fugitive dust controls implemented under the Post-CAAA scenario (e.g., unpaved road dust suppression, agricultural tilling controls, etc.) tend to be applied in relatively low population areas. | N/A |

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|---|---|---|---|
| Exclusion of C-R functions from short-term exposure studies in PM mortality calculations. | Underestimate | Potentially major. PM/mortality is the top contributor to the net benefits estimate. If short-term functions contribute substantially to the overall PM-related mortality estimate, then the net benefits could be underestimated. | Medium. Long-term PM exposure studies likely capture a large part of the impact of short-term peak exposure on mortality; however, the extent of overlap between the two study types is unclear. |
| No quantification of health effects associated with exposure to air toxics. | Underestimate | Potentially minor. Studies have found air toxics cancer risks to be orders of magnitude lower than those of criteria pollutants. | N/A Current data and methods are insufficient to develop (and value) national quantitative estimates of the health effects of these pollutants. |