

## **SAB June 11-13 Review Charge Questions**

May 12, 2003

This document conveys a set of specific charge questions which EPA respectfully requests that the SAB Council consider during its review of the May 12, 2003 draft analytical blueprint for the upcoming section 812 benefit-cost study of the Clean Air Act. The charge questions are organized by blueprint chapter or appendix. The first question posed for each chapter or appendix is intended to serve as a general charge question consistent with the statutory criteria for Council review of the section 812 studies.<sup>1</sup> Additional, more detailed charge questions are also conveyed for most chapters and appendices. These supplemental charge questions reflect EPA's desire to obtain specific and detailed advice from the Council on particular analytical issues.

### Chapter 1: Project Goals and Analytical Sequence

1. Does the Council support the study goals, general analytical framework, disaggregation plan, analytical sequence, and general analytical refinements defined in chapter 1? If there are particular elements of these plans which the Council does not support, are there alternatives the Council recommends?

### Chapter 2: Scenario Development

2. Does the Council support the choices for analytical scenarios defined in chapter 2? Are there alternative or additional scenarios the Council recommends EPA consider for inclusion in the analysis?
3. Does the Council support the alternative compliance pathway estimation and comparison methodology described in chapter 2, including the specification of alternative compliance pathways which may not reflect precisely constant emissions or air quality outcomes between scenarios due (primarily) to the non-continuous nature and interaction effects of emission control options?

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<sup>1</sup> (g) The Council shall—

- (1) review the data to be used for any analysis required under this section and make recommendations to the Administrator on the use of such data;
- (2) review the methodology used to analyze such data and make recommendations to the Administrator on the use of such methodology; and
- (3) prior to the issuance of a report required under subsection (d) or (e), review the findings of such report, and make recommendations to the Administrator concerning the validity and utility of such findings. [CAA §312(g)(1)-(3)]

### Chapter 3: Emissions Estimation

4. Does the Council support the plans for estimating, evaluating, and reporting emissions changes as defined in chapter 3? If there are particular elements of these plans which the Council does not support, are there alternative data or methods the Council recommends?
5. Chapter 3 of the analytical plan describes several alternative approaches considered by EPA for estimating non-EGU emissions growth rates. These options reflect different relative emphasis between two conflicting analytical objectives: (1) extensive refinement of the geographically-differentiated, source-specific economic activity growth estimates embedded in EGAS 4.0, and (2) maintaining the current project schedule and budget. EPA plans to use “approach #4”, a compromise option which targets the most important source categories for potential refinement. Does the Council support the initial plan to use “approach #4”? If the Council does not support the use of approach #4, are there other approaches –including either the approaches described in chapter 3 or others identified by the Council– which the Council suggests EPA consider?
6. Some state-supplied emissions data incorporated in the 1999 National Emissions Inventory (NEI) –the core emissions inventory for this analysis– incorporate different emissions factors from those used in MOBILE6, the mobile source emissions model EPA plans to use for estimating emissions changes between scenarios. Of particular importance, some of the emissions factors embedded in California’s EMFAC model may be significantly different from factors used in MOBILE6. EPA considered three options for estimating emissions changes in California, which are described in chapter 3. EPA plans to implement option #3 based on the belief that the emission factors embedded by California in its EMFAC model may be more accurate for their particular state than the factors incorporated in MOBILE6. Does the Council support the plan to implement option #3? If the Council does not support the adoption of option #3, are there other options –including either the options described in chapter 3 or others identified by the Council– which the Council suggests EPA consider?

### Chapter 4: Cost Estimates

7. Does the Council support the plans for estimating, evaluating, and reporting compliance costs described in chapter 4? If there are particular elements of these plans which the Council does not support, are there alternative data or methods the Council recommends?
8. EPA seeks advice from the Council concerning the choice of Computable General Equilibrium (CGE) model which EPA intends to use as a post-processor to gauge the general equilibrium effects of the various control scenarios. In the first 812 study –the retrospective– EPA used the Jorgenson/Wilcoxon model to gauge the general equilibrium effects of returning to the economy the reported compliance expenditures which formed the basis of the retrospective study direct cost estimates. This model has since been refined in many ways, and EPA considers both the Jorgenson/Wilcoxon/Ho and AMIGA to be acceptable tools. Although a final decision on model choice can be deferred until later in the analysis, EPA has tentative plans to use the AMIGA model because of its greater sectoral disaggregation, better industrial sector matching with CAA-

affected industries, richer representation of relevant production and consumption technologies, and better model validation opportunities due to its use of open code. Does the Council support the current, tentative plan to use the AMIGA model for this purpose? If not, are there alternative model choices or selection criteria the Council recommends?

9. In the two previous 812 studies, the primary cost estimates reflected use of a 5 percent real discount rate, which an earlier Council endorsed as a reasonable compromise between a 3 percent real rate considered by EPA to be most consistent with prevailing literature and a 7 percent rate based on the 1992 update of OMB's Circular A-94. The EPA-preferred 3 percent rate was, and is, designed to be consistent with a consumption rate of interest discounting concept, while the OMB-preferred 7 percent rate was, and is, intended to reflect the opportunity cost of private capital investment. Limited sensitivity testing was also conducted in the previous 812 studies by substituting –where possible– 3 and 7 percent rates to annualize the benefit and cost streams. EPA's new Economics Guidelines (peer-reviewed by the SAB EEAC) call for using a 2-3 percent rate consistent with the consumption rate of interest for primary analysis while acknowledging the need to also provide results based on a 7 percent rate as required by OMB Circular A-94. A recent draft of new OMB economic guidelines suggests providing results based on both 3 and 7 percent discount rates, while also acknowledging the need for further efforts to refine analytical policies for discounting methods and rates. EPA is concerned that presentation of multiple sets of “primary” results may breed unjustifiable confusion, particularly given the expected insensitivity of the overall results to the discount rate assumption. Therefore, EPA proposes to base the “primary” estimates on a 3 percent rate consistent with both prevailing peer-reviewed EPA Economic Guidelines, and to present these estimates as the principal results of the analysis. The 812 analysis would also conduct and present sensitivity tests using the OMB-prescribed 7 percent rate. Does the Council support this approach? If not, are there alternative rates, discounting concepts, methods, or results presentation approaches the Council recommends?

#### Chapter 5: Air Quality Modeling

10. Does the Council support the plans described in chapter 5 for estimating, evaluating, and reporting air quality changes associated with the analytical scenarios? If there are particular elements of these plans which the Council does not support, are there alternative data, models, or methods the Council recommends?

#### Chapter 6: Human Health Effects Estimation

11. Does the Council support the plans described in chapter 6 for estimating, evaluating, and reporting changes in health effect outcomes between scenarios? If there are particular elements of these plans which the Council does not support, are there alternative data or methods the Council recommends?
12. EPA seeks advice from the Council regarding the technical and scientific merits of incorporating several new or revised endpoint treatments in the current analysis. These health effect endpoints include:

- a. Premature mortality from particulate matter in adults 30 and over, PM (Krewski et al., 2000);
  - b. A PM premature mortality supplemental calculation for adults 30 and over using the Pope 2002 ACS follow-up study with regional controls;
  - c. Hospital admissions for all cardiovascular causes in adults 20-64, PM (Moolgavkar et al., 2000);
  - d. ER visits for asthma in children 0-18, PM (Norris et al., 1999);
  - e. Non-fatal heart attacks, adults over 30, PM (Peters et al., 2001);
  - f. School loss days, Ozone (Gilliland et al., 2001; Chen et al., 2000);
  - g. Hospital admissions for all respiratory causes in children under 2, Ozone (Burnett et al., 2001); and,
  - h. Revised sources for concentration-response functions for hospital admission for pneumonia, COPD, and total cardiovascular: Samet et al., 2000 (a PM10 study), to Lippmann et al., 2000 and Moolgavkar, 2000 (PM2.5 studies).
13. EPA seeks advice from the Council regarding the merits of applying updated data for baseline health effect incidences, prevalence rates, and other population characteristics as described in chapter 6. These updated incidence/prevalence data include:
- a. Updated county-level mortality rates (all-cause, non-accidental, cardiopulmonary, lung cancer, COPD) from 1994-1996 to 1996-1998 using the CDC Wonder database;
  - b. Updated hospitalization rates from 1994 to 1999 and switched from national rates to regional rates using 1999 National Hospital Discharge Survey results;
  - c. Developed regional emergency room visit rates using results of the 2000 National Hospital Ambulatory Medical Care Survey;
  - d. Updated prevalence of asthma and chronic bronchitis to 1999 using results of the National Health Interview Survey (HIS), as reported by the American Lung Association (ALA), 2002;
  - e. Developed non-fatal heart attack incidence rates based on National Hospital Discharge Survey results;
  - f. Updated the national acute bronchitis incidence rate using HIS data as reported in ALA, 2002, Table 11;

- g. Updated the work loss days rate using the 1996 HIS data, as reported in Adams, et al. 1999, Table 41;
  - h. Developed school absence rates using data from the National Center for Education Statistics and the 1996 HIS, as reported in Adams, et al., 1999, Table 46.
  - i. Developed baseline incidence rates for respiratory symptoms in asthmatics, based on epidemiological studies (Ostro et al. 2001; Vedal et al. 1998; Yu et al; 2000; McConnell et al., 1999; Pope et al., 1991).
14. EPA plans to initiate an expert elicitation process to develop a probability-based method for estimating changes in incidence of PM-related premature mortality. Plans for this expert elicitation are described in chapter 9 of this blueprint, and a separate charge question below requests advice from the Council pertaining to the merits of the design of this expert elicitation. EPA recognizes, however, the possibility that this expert elicitation process may not be fully successful and/or may not be completed in time to support the current 812 analysis. Therefore, in order to facilitate effective planning and execution of the early analytical steps which provide inputs to the concentration-response calculations, EPA seeks advice from the Council regarding the scientific merits of alternative methods for estimating the incidences of PM-related premature mortality, including advice pertaining to the most scientifically defensible choices for the following specific factors:
- a. Use of cohort mortality studies, daily mortality studies, or some combination of the two types of studies
  - b. Selection of specific studies for estimating long-term and/or short-term mortality effects
  - c. Methods for addressing –either quantitatively or qualitatively– uncertain factors associated with the relevant concentration-response function(s), including
    - i. Shape of the PM mortality C-R function (e.g., existence of threshold),
    - ii. PM causality,
    - iii. PM component relative toxicity, and
    - iv. PM mortality effect cessation lag structure
    - v. Cause of death and underlying health conditions for individuals dying prematurely due to chronic and/or short term exposures to particulate matter
15. In two recent mobile source rulemaking analyses, two recent Title III MACT rulemaking analyses, and the benefits analysis for the Clear Skies Initiative, EPA included an “Alternative Estimate” in addition to a “Base Estimate” of total monetized benefits. The Alternative Estimates included in these five analyses differed in some respects, but in each case they reflected some combination of alternative assumptions regarding key factors in the estimation of PM-related benefits, particularly premature mortality and chronic bronchitis. Because these alternative estimates were motivated in part by the lack of a more fully developed probabilistic methodology able to incorporate the most important analytical uncertainties –and a more extensive probabilistic uncertainty analysis is planned for the current analysis– EPA plans not to incorporate an

Alternative Estimate similar to those adopted in the five recent EPA analyses. However, if the probability-based uncertainty analysis is not considered sufficiently extended by other federal agencies, there may be significant pressure on EPA to incorporate an Alternative Estimate similar, or identical, to those incorporated in the recent analyses. EPA seeks advice from the Council pertaining to the merits and utility of adding an Alternative Estimate similar to those incorporated in the five recent EPA analyses, either in addition to or in lieu of a probability-based uncertainty analysis. In addition to providing advice on the overall merit of using an Alternative Estimate approach, EPA seeks advice pertaining to the scientific and technical merit of three specific adjustments to EPA Primary Estimate methods incorporated in the recent Alternative Estimates, including:

- a. Exclusive reliance on short-term mortality studies to estimate PM incidence changes (i.e., an assumption of zero effect from chronic exposure)
- b. An assumption that a specific proportion of the PM-related premature mortality incidences are incurred by people with pre-existing Chronic Obstructive Pulmonary Disease (COPD) and that these incidences are associated with a loss of six months of life, regardless of age at death
- c. An assumption that the non-COPD incidences of PM-related premature mortality are associated with a loss of five years of life, regardless of age at death

(Additional components of the Alternative Estimate, including differences in valuation method, are addressed in a separate charge question below.)

#### Chapter 7: Ecological Effects

16. Does the Council support the plans described in chapter 7 for (a) qualitative characterization of the ecological effects of Clean Air Act-related air pollutants, (b) an expanded literature review, and (c) a quantitative, ecosystem-level case study of ecological service flow benefits? If there are particular elements of these plans which the Council does not support, are there alternative data or methods the Council recommends?
17. Initial plans described in chapter 7 reflect a preliminary EPA decision to base the ecological benefits case study on Waquoit Bay in Massachusetts. Does the Council support these plans? If the Council does not support these specific plans, are there alternative case study designs the Council recommends?
18. Does the Council support the plan for a feasibility analysis for a hedonic property study for valuing the effects of nitrogen deposition/eutrophication effects in the Chesapeake Bay region, with the idea that these results might complement the Waquoit Bay analysis?

## Chapter 8: Economic Valuation

19. Does the Council support the plans described in chapter 8 for economic valuation of changes in outcomes between the scenarios? If there are particular elements of these plans which the Council does not support, are there alternative data or methods the Council recommends?
  
20. Pursuant to SAB Council advice from the review of the first draft analytical blueprint, EPA reviewed a number of meta-analyses –either completed or underway– developed to provide estimates for the value of statistical life (VSL) to be applied in the current study. EPA plans to use VSL estimates from the Kochi et al (2002) meta-analysis to generate the primary benefits estimates for this study. In addition, EPA plans to implement two particular adjustments to the core VSL value from Kochi et al (2002): discounting of lagged effects and longitudinal adjustment to reflect changes in aggregate income. Does the Council support these plans, including the specific plans for the adjustments described in chapter 8? If the Council does not support these plans, are there alternative data or methods the Council recommends?
  
21. As described in charge question 15, EPA has recently incorporated an Alternative Estimate of benefits in several recent Office of Air and Radiation analyses. In addition to the alternative assumptions related to health effects estimation described in charge question 15, the Alternative Estimates in these analyses applied methods or assumptions for economic valuation which differ significantly from approaches used by EPA to generate base estimates. EPA seeks advice pertaining to the scientific and technical merit of four adjustments to EPA Primary Estimate methods incorporated in the recent Alternative Estimates, including:
  - a. An initial VSL derived by using only five contingent valuation (CV) studies from the larger set of 26 hedonic wage and CV studies used to generate Primary Estimates in the previous 812 studies
  - b. Age-based adjustment to the CV-based VSL estimate described above using Jones-Lee (1989) –but not Jones-Lee (1993)– which had the practical effect of reducing initial VSL for people aged 70 and above by 37 percent [note: this was the approach used for the recreational vehicle and the Clear Skies Initiative analyses, but not the most recent analysis of the proposed nonroad diesel vehicle rule]
  - c. Age-based adjustment to the CV-based VSL estimate described above using a statistical life-years approach which assumed that later life-years may have a higher per-year value than average life-years saved in the middle of the life span [note: this was the approach used in the analysis of the proposed nonroad diesel vehicle rule]
  - d. Use of a cost of illness estimate based on Cropper and Krupnick (1990) to estimate the value of avoided chronic bronchitis, rather than the willingness to pay estimates used to generate Primary benefit estimates in the previous 812 studies
  
22. Does the Council support the derivation of VSLY values based on the life expectancy of the general population for application to individual loss of life years in individuals with greatly

reduced life expectancy relative to the general population? If the Council does not support this approach, are there any life years-based valuation methods that the Council finds to be consistent with a standard welfare economics-based cost-benefit analysis?

23. EPA plans to use updated unit values for a number of morbidity effects, as described in chapter 8. Of particular note, EPA plans to rely on a study by Dickie and Ulery (2002) to provide heretofore unavailable estimates of parental willingness to pay to avoid respiratory symptoms in their children. This study is not yet published; however, EPA expects the study to be published prior to completion of the economic valuation phase of this analysis. Does the Council support the application of unit values from this study, contingent on its acceptance for publication in a peer-reviewed journal? If the Council does not support reliance on this study, are there other data or methods for valuation of respiratory symptoms in children which the Council recommends?
24. In the previous prospective 812 study and in the June 2001 draft blueprint for the current study, EPA expressed a preference not to report results in terms of QALY-based cost-effectiveness. This preference was motivated primarily by (1) the lack of generally accepted data and methods applicable to QALY computation in an air pollution context, (2) potential biases in the implicit cost-effectiveness results caused by incomplete netting out of other health and ecological benefits from the numerator, (3) concerns about the distortionary effect of the simplifying assumptions pertaining to time and quality trade-offs required to estimate QALYs, and (4) the general disconnect between available QALY methodologies and standard economic utility theory. In addition, EPA is seriously concerned about the requirement imposed by the QALY methodology to assign lower values to the lives, and the quality of the lives, of people of advanced age and/or impaired health status. However, the SAB Council in its review of the June 2001 draft blueprint recommended that EPA consider reporting results in terms of implied cost-effectiveness using QALYs or value of statistical life year (VSLY). Does the Council support the specific plans for QALY-based cost-effectiveness described in the current draft blueprint, including the plan to present these results in a less-prominent manner than the benefit-cost-based Primary results (e.g., in a main report sidebar text box or an appendix)? If the Council does not support specific elements of these plans, are the alternative data, methods, or results presentation approaches which the Council recommends?

#### Chapter 9: Uncertainty Analysis

25. Does the Council support the plans described in chapter 9 for estimating and reporting uncertainty associated with the benefit and cost estimates developed for this study? If there are particular elements of these plans which the Council does not support, are there alternative data, models, or methods the Council recommends?
26. Does the Council support the plans described in chapter 9 for the pilot project to develop probability-based estimates for uncertainty in the compliance cost estimates? If the Council does not support this pilot project, or any particular aspect of its design, are there alternative approaches to quantifying uncertainty in cost estimates for this analysis which the Council recommends?

27. Does the Council support the plans described in chapter 9 for the pilot project to develop probability-based estimates for uncertainty in the emissions and air quality modeling estimates? If the Council does not support this pilot project, or any particular aspect of its design, are there alternative approaches to quantifying uncertainty in emissions and/or air quality concentration estimates for this analysis which the Council recommends?
28. Does the Council support the plans described in chapter 9 for the expert elicitation pilot project to develop a probability-based PM2.5 C-R function for premature mortality, including in particular the elicitation process design? If the Council does not support the expert elicitation pilot project, or any particular aspect of its design, are there alternative approaches the Council recommends for estimating PM-related mortality benefits for this analysis, including in particular a probabilistic distribution for the C-R function to reflect uncertainty in the overall C-R function and/or its components?
29. EPA plans to develop estimates of an independent mortality effect associated with ozone, as described in chapter 9. Does the Council support the use of the most recent literature on the relationship between short-term ozone exposure and daily death rates, specifically that portion of the literature describing models which control for potential confounding by PM2.5? Does the Council agree with the use of that literature as the basis for deriving quantified estimates of an independent mortality impact associated with ozone, especially in scenarios where short-term PM2.5 mortality estimates are used as the basis for quantifying PM mortality related benefits? Does the Council support the plans described in chapter 9 for the pilot project to use this literature to develop estimates of the ozone-related premature mortality C-R function using the three alternative meta-analytic approaches? If the Council does not support this pilot project, or any particular aspect of its design, are there alternative approaches to quantifying ozone-related premature mortality which the Council recommends?
30. EPA plans to apply the Kochi et al (2002) meta-analysis to derive an initial value for VSL, as described in Appendix H (a separate charge question pertaining to this element of EPA's VSL plan is presented below). In addition, EPA plans to conduct a follow-on meta-regression analysis of the existing VSL literature to provide insight into the systematic impacts of study design attributes, risk characteristics, and population attributes on the mean and variance of VSL. Does the Council support the plans described in chapter 9 for conducting this meta-regression analysis? If the Council does not support this analysis or any particular aspect of its design, are there alternative approaches which the Council recommends for quantifying the impact of study design attributes, risk characteristics, and population attributes on the mean and variance of VSL?
31. Does the Council support the plans described in chapter 9 for, if necessary upon review and evaluation of the VSL meta-regression, conducting a formal expert elicitation analysis to develop probabilistic representations of the distribution of the value of a statistical life, with the potential for separate distributions developed for individual age groups, and considering potentially influential variables, such as risk characteristics and health status, which may not be completely

captured in the meta-regression? If the Council does not support this expert elicitation project, or any particular aspect of its design, are there alternative approaches which the Council recommends for quantifying the influence of population or risk characteristics on the VSL estimates to be used in characterizing uncertainty for this study?

#### Chapter 10: Data Quality and Intermediate Data Products

32. Does the Council support the plans described in chapter 10 for evaluating the quality of data inputs and analytical outputs associated with this study, including the planned publication of intermediate data products and comparison of intermediate and final results with other data or estimates? If the Council does not support these plans, are there alternative approaches, intermediate data products, data or model comparisons, or other data quality criteria the Council recommends?

#### Chapter 11: Results Aggregation and Reporting

33. Does the Council support the plans described in Chapter 11 for the aggregation and presentation of analytical results from this study? If the Council does not support these plans, are there alternative approaches, aggregation methods, results presentation techniques, or other tools the Council recommends?

#### Appendix D: Stratospheric Ozone Analysis

34. Does the Council support the plans describe in Appendix D for updating the estimated costs and benefits of Title VI programs? If the Council does not support these plans, are there alternative data, models, or methods the Council recommends?

#### Appendix E: Air Toxics Case Study

35. Does the Council support the plans described in Appendix E for the benzene case study, including the planned specific data, models, and methods, and the ways in which these elements have been integrated? If the Council does not support these plans, are there alternative data, models, or methods the Council recommends?
36. A cessation lag for benzene-induced leukemia is difficult to estimate and model precisely due to data limitations, and EPA plans to incorporate a five-year cessation lag as an approximation based on available data on the latency period of leukemia and on the exposure lags used in risk models for the Pliofilm cohort (Crump, 1994 and Silver et al., 2002). Does the SAB support adoption of this assumed cessation lag? If the Council does not support the assumed five-year cessation lag, are there alternative lag structures or approaches the Council recommends?

Appendix H: Meta-analysis of VSL

37. Does the Council support the plans described in the analytical blueprint to apply the Kochi et al (2002) meta-analysis to derive an estimate for the value of avoided premature mortality attributable to air pollution? If the Council does not support these plans, are there alternative data, models, or methods the Council recommends?