U.S. Environmental Protection Agency
Clean Air Scientific Advisory Committee (CASAC)
Carbon Monoxide NAAQS Review Panel

Public Meeting: November 16-17, 2009

The Carolina Inn, 211 Pittsboro Street, Chapel Hill, NC 27516

Purpose: To review the *ISA for Carbon Monoxide: Second External Review Draft* and the *REA to Support the Review of the Carbon Monoxide Primary NAAQS: First External Review Draft* accessible at http://www.epa.gov/ttn/naaqs/standards/co/s_co_index.html.

Monday, 16 November 2009

8:30 a.m.	Convene the meeting	Ms. Kyndall Barry, Designated Federal Officer, EPA SAB Staff Office
	Welcome and remarks	Dr. Anthony Maciorowski, Deputy Director, EPA SAB Staff Office
8:40 a.m.	Introduction of Members, Review Agenda	Dr. Joe Brain, Chair
8:50 a.m.	Process and Schedule for Review	Ms. Lydia Wegman, EPA's Office of Air Quality Planning & Standards
9:00 a.m.	Update on 2nd Draft ISA and Agency Charge Questions (Attachment A)	Dr. John Vandenberg Dr. Mary Ross Dr. Thomas Long Ms. Debra Walsh EPA's National Center for Environmental Assessment
9:30 a.m.	Public Comment Period	To be announced
9:45 a.m.	Response to ISA Charge Question 1	Dr. Anne Sweeney Dr. Christopher Frey Dr. Joel Kaufman Dr. Beate Ritz
10:15 a.m.	Break	
10:30 a.m.	Response to ISA Charge Question 2	Dr. Paul Roberts Dr. Russell Dickerson Dr. Ted Russell
11:15 a.m.	Response to ISA Charge Question 3	Dr. Milan Hazucha Dr. Thomas Dahms Dr. Michael Kleinman

12:00 p.m.	Lunch	
1:00 p.m.	Response to ISA Charge Question 4	Dr. Arthur Penn Dr. Paul Blanc Dr. Francine Laden Dr. Stephen Thom
1:45 p.m.	Response to ISA Charge Question 5	Dr. Laurence Fechter Dr. Joel Kaufman Dr. Anne Sweeney Dr. Beate Ritz
2:30 p.m.	Response to ISA Charge Question 6	Dr. Paul Blanc Dr. Christopher Frey Dr. Ted Russell Dr. Stephen Thom
3:15 p.m.	Break	
3:30 p.m.	Summary of Major ISA Review Comments	Dr. Joe Brain
4:00 p.m.	Highlights of 1st Draft REA and Agency Charge Questions (Attachment B)	Dr. Deirdre Murphy Dr. Ines Pagan Dr. Souad Benromdhane Dr. Stephen Graham EPA's Office of Air Quality Planning and Standards
4:30 p.m.	Public Comment Period	To be announced
4:45 p.m.	Recess for day (Writing Session)	

Tuesday, 17 November 2009

8:30 a.m.	Reconvene the Panel Meeting Discussion of REA	Ms. Kyndall Barry
8:40 a.m.	Response to REA Charge Question for Chapter 3	Dr. Russell Dickerson Dr. Paul Roberts
9:10 a.m.	Response to REA Charge Questions for Chapters 2 and 4, Sections 5.3.7 and 6.2	Dr. Thomas Dahms Dr. Milan Hazucha Dr. Joel Kaufman Dr. Michael Kleinman Dr. Arthur Penn Dr. Stephen Thom
10:15 a.m.	Break	

10:30 a.m.	Response to REA Charge Questions 1-3 for Chapters 5 and 6	Dr. Ted Russell Dr. Christopher Frey Dr. Paul Roberts
11:15 a.m.	Response to REA Charge Question 4 for Chapters 5 and 6	Dr. Christopher Frey Dr. Francine Laden
12:00 p.m.	Lunch	
12:45 p.m.	Response to REA Charge Questions 5-6 for Chapters 5 and 6	Dr. Beate Ritz Dr. Paul Blanc Dr. Lawrence Fechter Dr. Anne Sweeney
2:00 p.m.	Summary and Next Steps	Dr. Joe Brain
2:30 p.m.	Adjourn	Ms. Kyndall Barry

Attachment A: Charge to the CASAC CO Panel re: 2nd Draft ISA

We are specifically asking that the CASAC CO Panel comment on the following topic areas that focus on more substantive chapter revisions, but would also appreciate any other feedback from their review of the second draft ISA:

1. Chapter 1 has been revised in response to comments from the CO Panel, as well as related comments from the CASAC PM Panel, to add information regarding criteria for study selection and evaluation, to add more CO-specific information to the framework for causal determination, and to more clearly describe the process of integrating evidence from various disciplines to classify the overall weight of evidence relating to causality. What are the views of the Panel on the extent to which this revised Chapter 1 provides necessary and sufficient background information for review of the subsequent chapters of the CO ISA?

2. Chapter 3 has been revised and expanded in response to Panel comments regarding climate, monitoring, spatial variability, and exposure.

    a. Evidence reviewed in Chapter 3 of the ISA indicates that the direct contribution of CO to greenhouse warming is very small, while the role of CO in atmospheric chemistry cycles involving other species makes a larger contribution to radiative forcing. This combined evidence leads to the conclusion in Chapter 2 that a causal relationship exists between current atmospheric concentrations of CO and effects on climate. What are the Panel's opinions related to this causal statement and the evidence provided to support it?

    b. Additional detail has been provided regarding the detection limits of CO monitors in the regulatory network, the number of monitors reporting at each horizontal spatial measurement scale and comparison of monitoring data at each scale, and spatial variability of CO concentrations near major sources, particularly roadways. Please comment on the usefulness of these revisions in characterizing the information provided by the CO monitoring network.

    c. The section on exposure assessment has been reorganized to provide information on exposure assessment at different spatial scales and to create a subsection containing information regarding exposure error and its implications for interpretation of epidemiologic studies. Does the Panel consider that the sources of exposure error have been appropriately characterized, and agree with the revised conclusions regarding the impact of exposure error due to spatial variability and the presence of CO as part of a combustion-related mixture on health effect estimates from time-series epidemiologic studies?

3. In response to comments from the CASAC CO Panel, material has been added to Chapter 4 describing comparisons among predictive COHb models, the relative influence of differing exposure scenarios on COHb concentration, and endogenous CO production rates in individuals with various diseases and conditions. Please comment on the usefulness of this information in illustrating the factors influencing COHb kinetics and potential COHb levels under various scenarios.

4. The discussion of the health effects evidence in Chapter 5 has been revised to add studies published after the release of the first draft ISA and provide more detail on the findings of the most relevant studies.

   The cardiovascular effects section has been expanded to:

   - evaluate key uncertainties in the health evidence, particularly regarding the biological plausibility of effects at low ambient CO concentrations and distinguishing independent effects of CO in multipollutant ambient mixtures;
   - provide more detail on the design and findings of a multicenter controlled human exposure study to clarify the levels at which effects were observed;
   - add description of new epidemiologic studies, including a large U.S. multicity study and studies on associations between blood markers and ambient CO concentrations; and
   - more clearly describe the integration of controlled human exposure and epidemiologic evidence to reach a causal determination.

   The material on mode of action has been revised to describe altered NO signaling by CO in greater detail and to expand the discussion of differences between intracellular CO derived from endogenous and exogenous sources.

   We would appreciate CASAC comment on these revisions to Chapter 5 and the conclusions for each of the health outcomes evaluated in this chapter. In particular, we are requesting CASAC comment on the interpretation of the evidence and the causal determination for short-term exposure to CO and cardiovascular morbidity.

5. The section on susceptible populations has been revised substantially in response to comments from the CASAC CO Panel and in consideration of similar comments from the CASAC PM Panel. The definition of a susceptible population has been clarified, and each subsection describing a susceptibility characteristic has been revised to emphasize specific evidence from controlled human exposure studies of individuals with underlying disease, epidemiologic studies that conducted stratified analyses to examine effect modification, and toxicological studies using animal disease models. Does this revised section provide appropriate characterization of populations potentially susceptible to CO-induced health effects?

6. Chapter 2 has been revised and expanded to provide more information on atmospheric science and exposure assessment, policy relevant considerations, and integration of CO health effects.

    a. The section on policy-relevant considerations was revised to present additional detail on the concentration-response relationship observed in a multi-center controlled human exposure study, present results from a new U.S. multicity epidemiologic study investigating the potential presence of a threshold and departure from linearity, and summarize the evidence for susceptible populations. Please comment on these revisions.

    b. A section and summary figure have been added to the end of Chapter 2 to summarize the main conclusions of the ISA regarding the health effects of CO and the range of concentrations at which effects are observed, along with uncertainties that complicate the interpretation of the evidence. We would appreciate CASAC comment on the material in this section and its effectiveness in presenting the conclusions of the ISA.

Attachment B: Charge to the CASAC CO Panel re: 1st Draft REA

Within each of the main sections of the first draft REA document, we ask the Panel to address the following questions:

Air Quality Considerations (Chapter 3)

1. Does the Panel find the considerations of current ambient carbon monoxide monitoring data and the discussion of the extent to which near roadway concentrations are represented to be technically sound, clearly communicated, and appropriately characterized?

Selection and use of Health Endpoint, Target Population and Risk Metric (Chapters 2 and 4, Sections 5.3.7 and 6.2)

To characterize CO risks, the risk/exposure assessment estimates the distribution of COHb levels in the adult population with coronary heart disease that are exposed to ambient CO.

1. Does the Panel find the description and selection of health endpoint, target population and risk metric (Chapters 2 and 4) to be technically sound, clearly communicated, and appropriately characterized?

2. Based on conclusions in the draft ISA regarding exacerbation of preexisting coronary heart disease in exercising individuals following CO exposures, we have selected potential health effect benchmark values of 1.5, 2.0, 2.5 and 3.0 % COHb. To what extent does this range of benchmark values appropriately reflect the controlled human exposure studies health effects evidence related to CO exposures evaluated in the draft ISA?

3. Does the Panel find the derivation and presentation of COHb estimates (sections 5.2.7 and 6.2) to be technically sound, clearly communicated, and appropriately characterized?

Characterization of Exposure (Chapters 5 and 6)

In recognition of key limitations in available data with regard to spatial detail of ambient concentrations, this draft REA employs a simplified approach to exposure assessment in the Denver and Los Angeles study areas. We are interested in eliciting the views of the Panel on the usefulness of this approach in informing our review the NAAQS for CO and we are also interested in the Panel's view on the relative merits of alternatives or modifications to this approach, in light of the characterization of uncertainty as well as the limitations of the current data and time constraints on this review.

1. Does the Panel find the summary of CO exposure and discussion of the relationship between in-vehicle and ambient concentrations to be technically sound, clearly communicated, and appropriately characterized?

2. What are the views of the Panel on the approach taken?

3. Does the Panel view the results of the exposure analyses to be technically sound, clearly communicated, and appropriately characterized?

4. What are the views of the Panel regarding the adequacy of the assessment of uncertainty and variability? To what extent have sources of uncertainty been identified and the implications for the risk characterization been addressed? To what extent has variability adequately been taken into account? Does the Panel have any recommendations for sensitivity analyses that they feel would improve this assessment?

5. To what extent does the simplified approach taken in this assessment help to characterize the public health implications of the current standards?

6. Does the Panel have any recommendations regarding how the approach might be modified to better characterize the public health implications of the current standards, in light of the uncertainty associated with the simplified approach, and current data and time constraints on this review?