Integrated Science Assessment for Oxides of Nitrogen – Health Criteria

2nd External Review Draft

Clean Air Science Advisory Committee Meeting May 1, 2008

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Charge Question 1

What are the views of the Panel on the characterization of the search strategy for identifying literature, criteria for study selection, the framework for scientific evaluation of studies and causality determination?

New Framework for Causal Determinations

Establish uniform language concerning causality and improve specificity of our findings:

- assess the separate and combined lines of evidence from epidemiology, clinical, animal and in vitro toxicology studies
- classify and characterize the data to evaluate causality

Adapted from the Surgeon General's Smoking Reports and the NAS/IOM document, "Improving the Presumptive Disability Decision-Making Process for Veterans" (2007)

Hill's Factors for Judging Causality

- Consistency of the observed association
- Strength of the observed association
- Specificity of the observed association
- Temporal relationship of the observed association
- Biological gradient (exposure-response relationship)
- Biological plausibility
- Coherence
- Experimental evidence (from human populations)
- Analogy

New Framework for Causal Determinations

A two-step approach is used to judge the scientific evidence about exposure to criteria pollutants and risks to public health.

The first step is to determine causality

- Sufficient to infer a *causal relationship*.
- Sufficient to infer a *likely causal relationship* (i.e., more likely than not).
- *Suggestive but not sufficient* to infer a causal relationship.
- *Inadequate to infer the presence or absence* of a causal relationship.
- *Suggestive of no causal relationship*.

The second step is further evaluation of the population response (e.g. the shape of concentration-response, susceptibility differences, ambient levels and exposure time periods at which effects are observed).

NCEA-RTP NOx TEAM

ISA IN SUPPORT OF THE PRIMARY STANDARD

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Charge Question 2

- To what extent are the atmospheric chemistry and air quality characterizations clearly communicated, appropriately characterized, and relevant to the review of the primary NO_2 NAAQS?

- Are the properties of ambient oxides of nitrogen appropriately characterized, including spatial and temporal patterns and relationships between ambient oxides of nitrogen and human exposure?

- Does the information in Chapter 2 provide a sufficient atmospheric science and exposure basis for the evaluation of human health effects presented in later chapters?

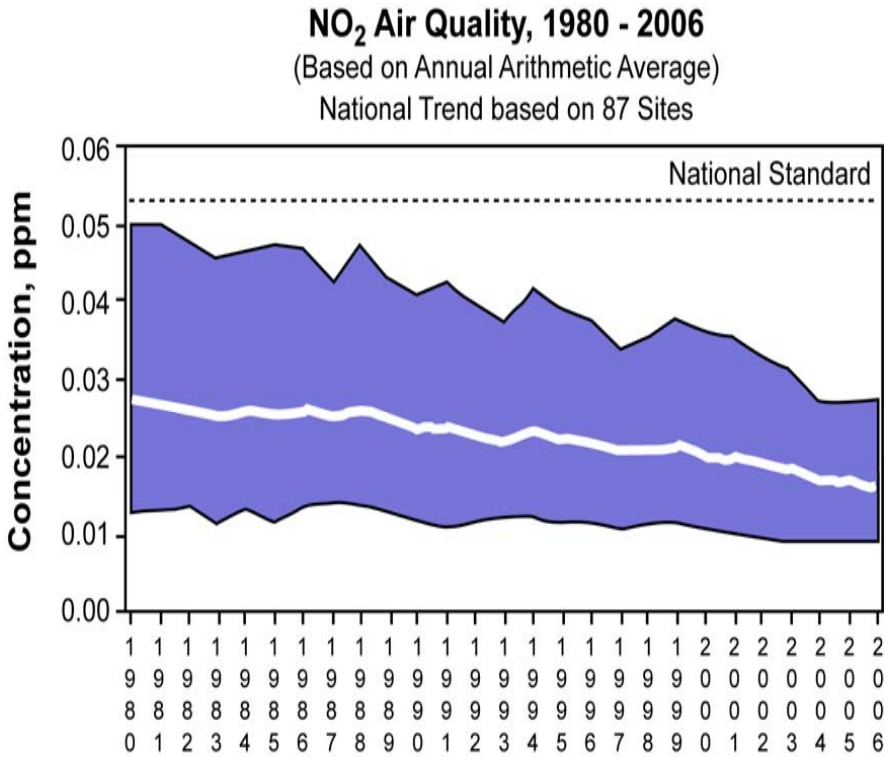
Response to CASAC Review

Ambient Measurement Methods and Concentrations

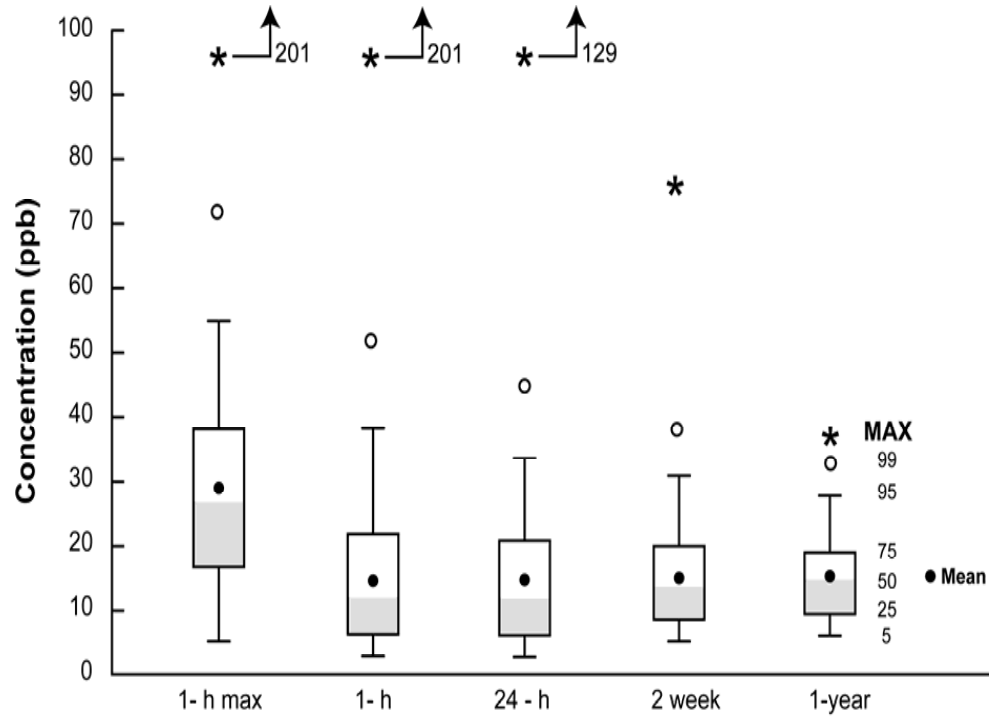
Spatial and Temporal Variability in Ambient NO_2 Concentrations

Association between Personal Exposures and Ambient Concentrations

Ambient Measurement Methods and Concentrations



1980 to 2006: 41% decrease in National Average



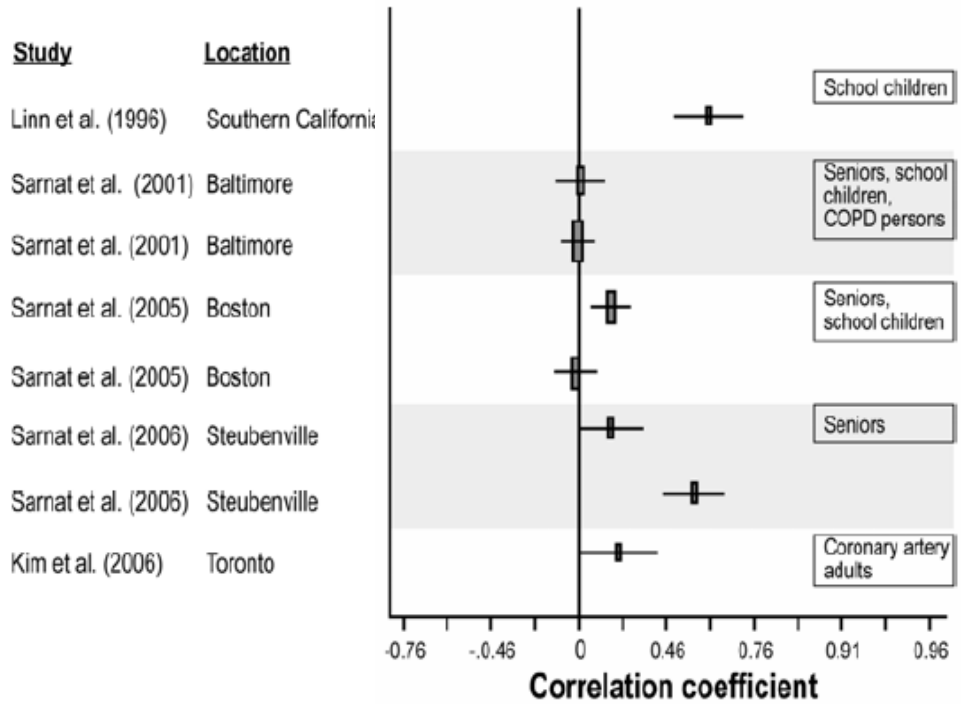
All MSAs with NO_2 monitors, 2003 - 2005

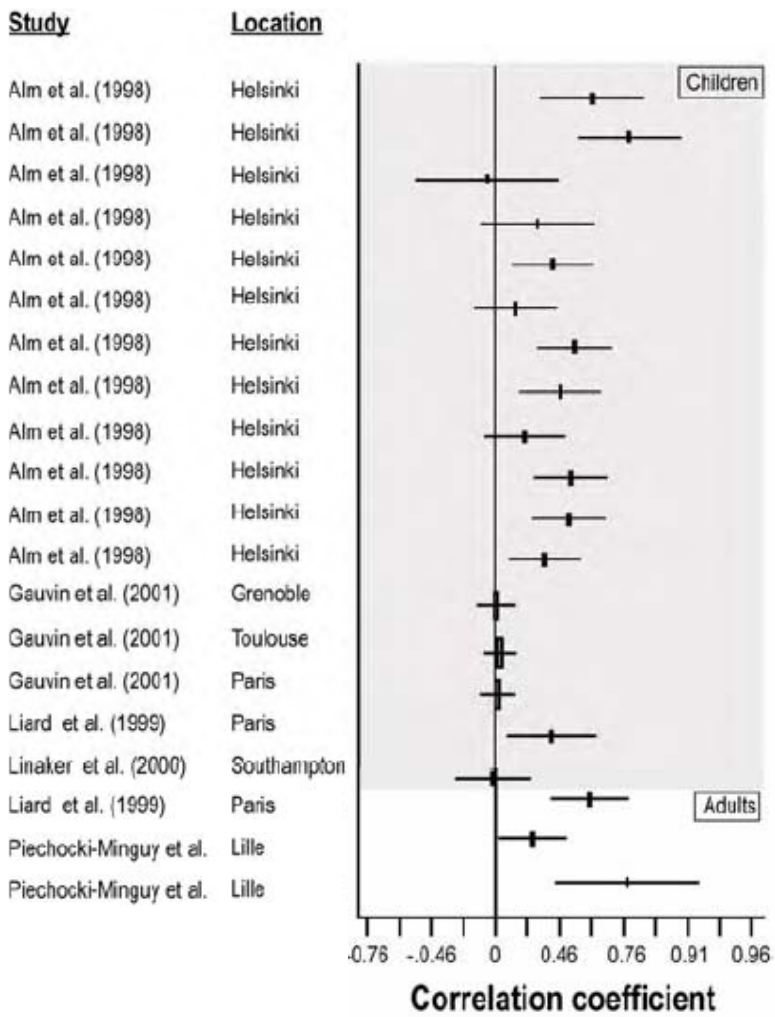
Spatial and Temporal Variability in Ambient NO_2 Concentration

City	Number of Monitors	Mean Concentration (ppb)	r	P90 (ppb)
New York, NY	5	29 (25–37)	0.77–0.90	7–19
Atlanta, GA	5	11 (5–16)	0.22–0.89	7–24
Chicago, IL	7	22 (6–30)	-0.05–0.83	10–39
Houston, TX	7	13 (7–18)	0.31–0.80	6–20
Los Angeles, CA	14	25 (14–33)	0.01–0.90	8–32
Riverside, CA	9	21 (5–32)	0.03–0.84	10–40

MSAs with 5 or more NO_2 monitors, 2003 – 2005

Association between Personal Exposures and Ambient Concentrations





Personal exposures to NO_2 can be associated with personal exposures to co-pollutants, such as PM and CO, as a result of common sources (e.g. traffic) and chemical reactions.

Charge Questions 3-5

- To what extent is the discussion and integration of evidence from the animal toxicology and controlled-exposure human experimental studies and epidemiologic studies, technically sound, appropriately balanced, and clearly communicated? What are the views of the Panel on the conclusions drawn in the draft ISA regarding the strength, consistency, coherence and plausibility of NO_2-related health effects?

- What are the views of the Panel on the characterization of groups likely to be susceptible or vulnerable to NO_2 and the potential public health impact of NO_2 exposure?

- What are the Panel's views on the adequacy of this second external review draft ISA to provide support for future exposure and policy assessments?

Response to CASAC Review

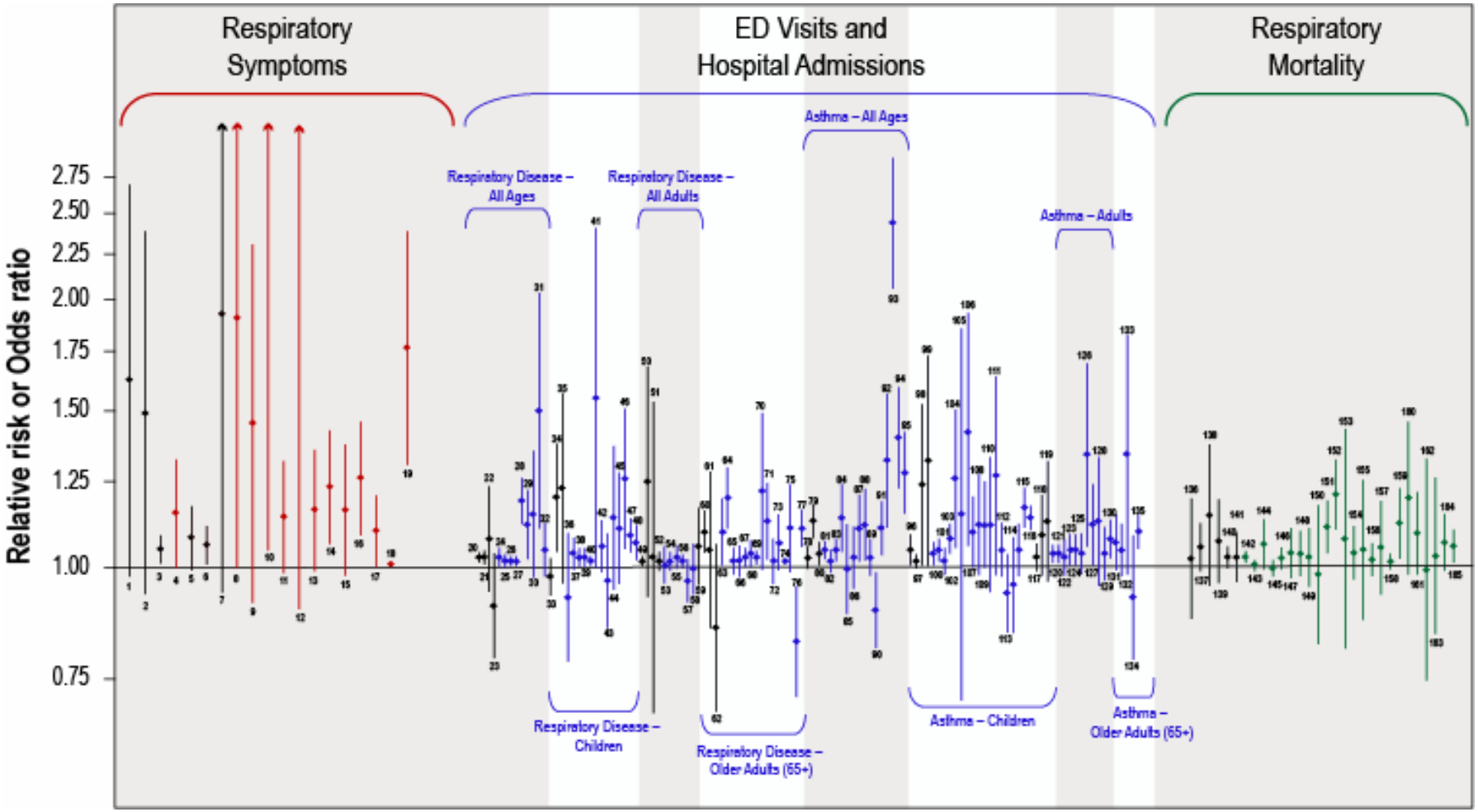
Ambient NO_2 is a component of a mixture of combustion-related pollutants, making it difficult to distinguish and quantify the individual effect of NO_2 in observational studies

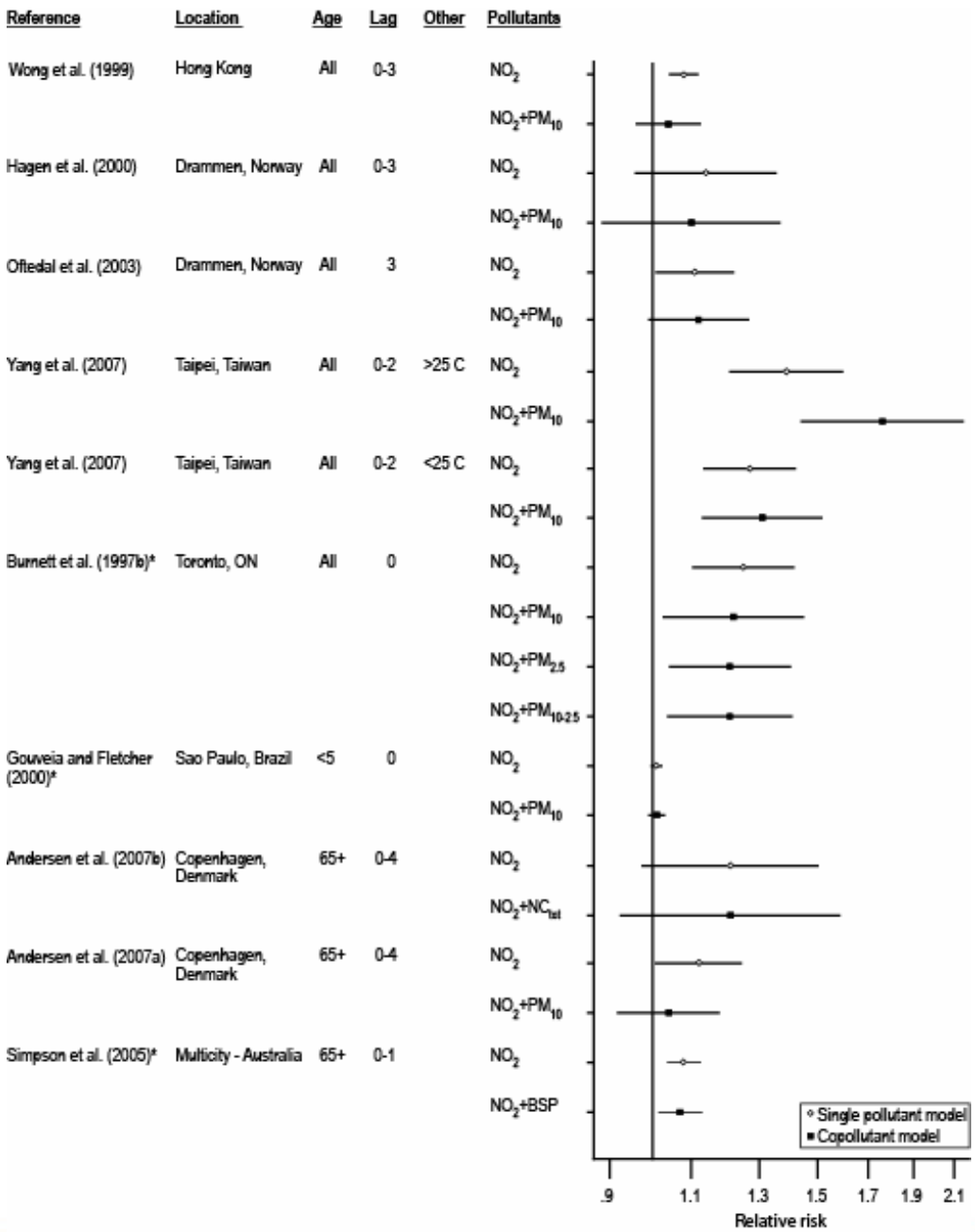
Evidence for an independent effect:

- Consistent, coherent, and biologically plausible respiratory effects
- Robust to inclusion of additional criteria pollutants in copollutant models

Current ambient NO_2 exposures can result in adverse impacts to public health at ambient concentrations below the current standard

Consistent and Coherent Results





Robust to inclusion of PM in co-pollutant models

Key Conclusions

Short-term Exposure

- Respiratory Morbidity: *sufficient to infer a likely causal relationship*
- Cardiovascular Morbidity: *inadequate to infer the presence or absence of a causal relationship*
- Mortality: *suggestive but not sufficient to infer a causal relationship*

Long-term Exposure

- Respiratory Morbidity: *suggestive but not sufficient to infer a causal relationship*
- Other Morbidity: *inadequate to infer the presence or absence of a causal relationship*
- Mortality: *inadequate to infer the presence or absence of a causal relationship*