

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
AGENDA ITEM REQUEST

AGENDA REQUESTED: November 19, 2014

DATE OF REQUEST: October 31, 2014

INDIVIDUAL TO CONTACT REGARDING CHANGES TO THIS REQUEST, IF NEEDED: Kerry Howard (512) 239-0556

CAPTION: Docket No. 2014-1553-MIS. Presentation on ozone health effects by Dr. Julie Goodman.

Stephanie Bergeron Perdue
Deputy Executive Director

Michael Honeycutt
Division Director

Joyce Nelson for Kerry Howard
Agenda Coordinator

Copy to CCC Secretary? NO X YES

Is a Stricter Ozone NAAQS Supported by the Science?

Julie E. Goodman, PhD, DABT, ACE, ATS

Texas Commission on Environmental Quality Agenda
Austin, Texas
November 19, 2014

EPA's Causal Classifications

Health Outcome	Short-term Exposure		Long-term Exposure	
	2006 AQCD	2013 ISA	2006 AQCD	2013 ISA
Respiratory effects (including mortality)	Causal	Causal	Suggestive	Likely to be causal
All-cause mortality	Suggestive	Likely to be causal	Little evidence	Suggestive
Cardiovascular effects (including mortality)	Suggestive	Likely to be causal	No conclusion	Suggestive

Primary Health Effects Evidence



Controlled Exposure Studies



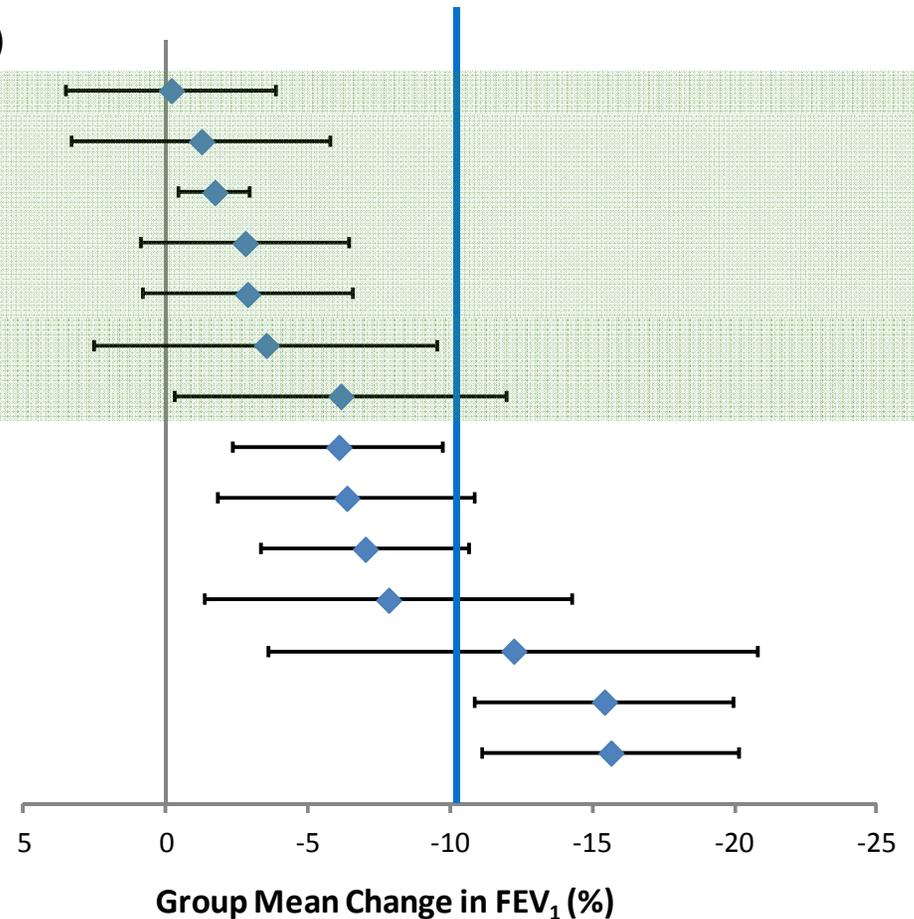
Epidemiology Studies



Experimental Studies

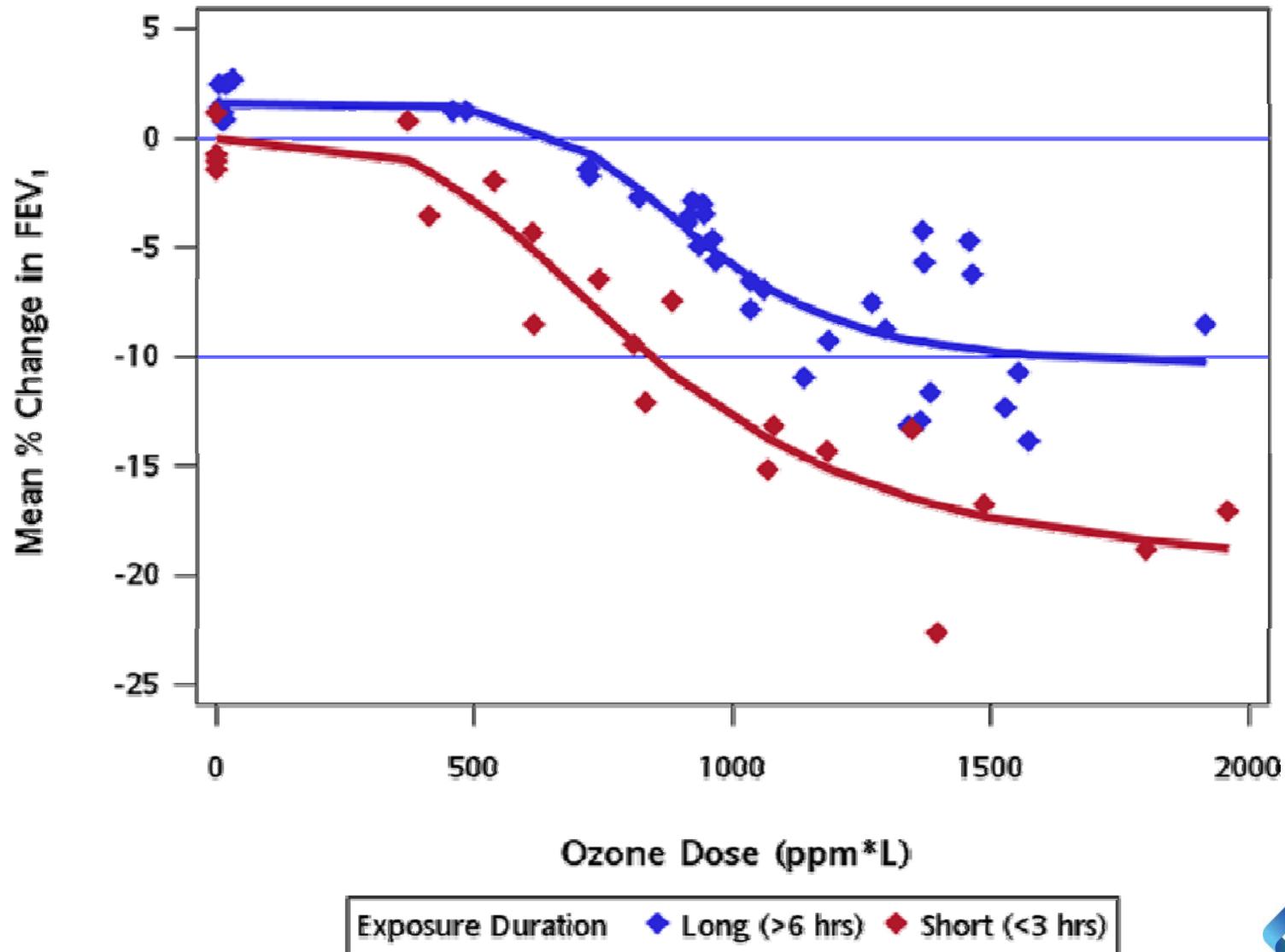
Controlled Exposure Studies

Study	Sample Size	Exposure	O ₃ Conc. (ppb)
Adams (2006)	30	CH-TRI	40
Adams (2002)	30	FM-SQR	40
Kim et al. (2011)	59	CH-SQR	60
Adams (2006)	30	CH-TRI	60
Adams (2006)	30	CH-SQR	60
Schelegle et al. (2009)	31	CH-TRI	63
Schelegle et al. (2009)	31	CH-TRI	72
Adams (2006)	30	CH-SQR	80
Adams (2002)	30	FM-SQR	80
Adams (2006)	30	CH-TRI	80
Schelegle et al. (2009)	31	CH-TRI	81
Schelegle et al. (2009)	31	CH-TRI	88
Adams (2002)	30	FM-SQR	120
Adams (2002)	30	CH-SQR	120



Adapted from Goodman *et al.* (2013)

Controlled Exposure Studies- Change in FEV₁ with Increasing Ozone Dose

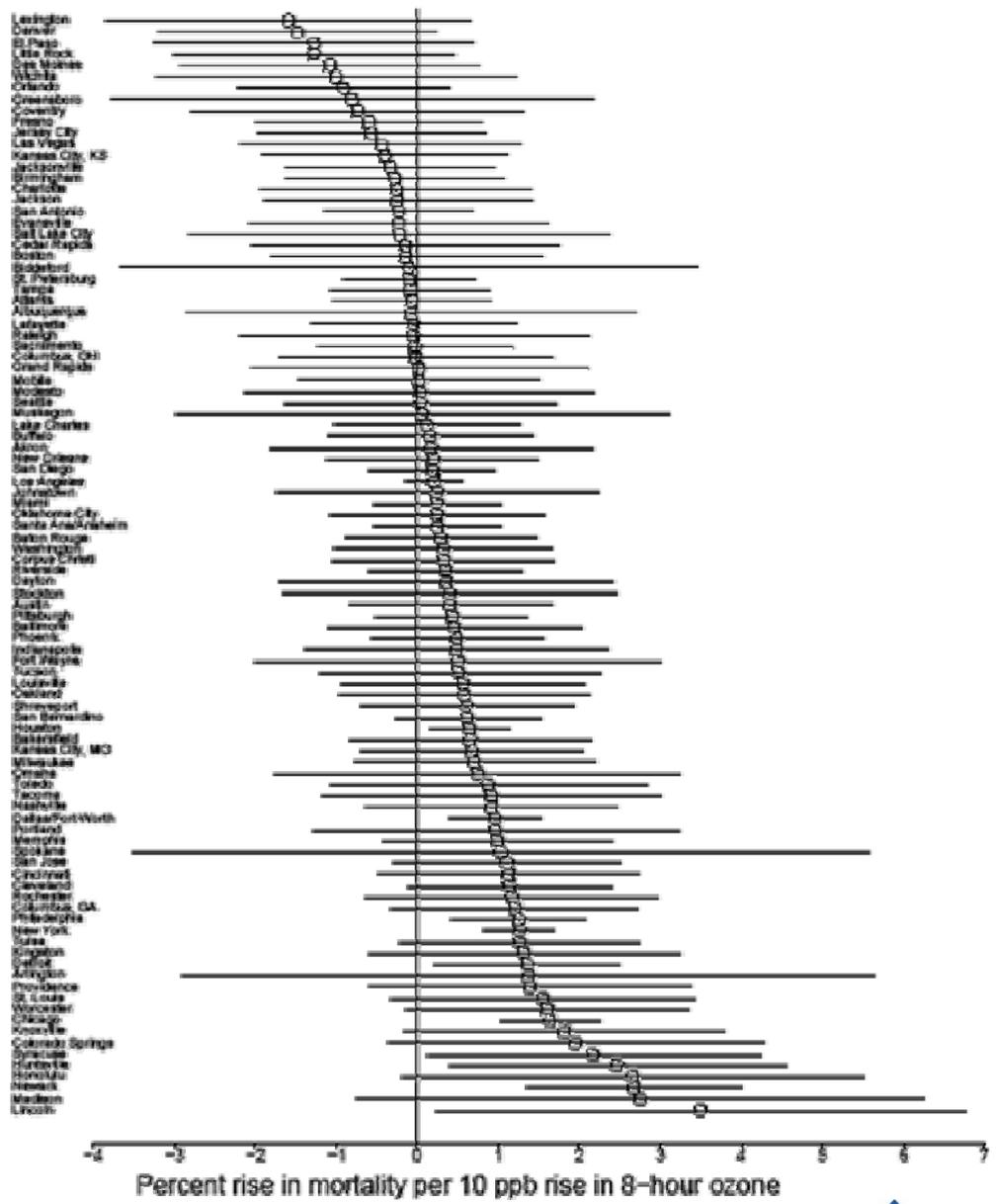


Short-term Exposure – Epidemiology Studies

- Risks are driven by mortality (not morbidity)
- New mortality studies are re-analyses
 - US multi-city studies of NMMAPS data (*e.g.*, Bell *et al.*, 2007)
 - Multi-country studies (*e.g.*, Katsouyanni *et al.* (2009) study of US, Canadian, and European cities)
- Different methodologies and model assumptions
- Unexplained heterogeneity across cities and countries
- Limitations: exposure measurement error, confounding (co-pollutants and temperature), and model specification

Example of NMMAPS Results

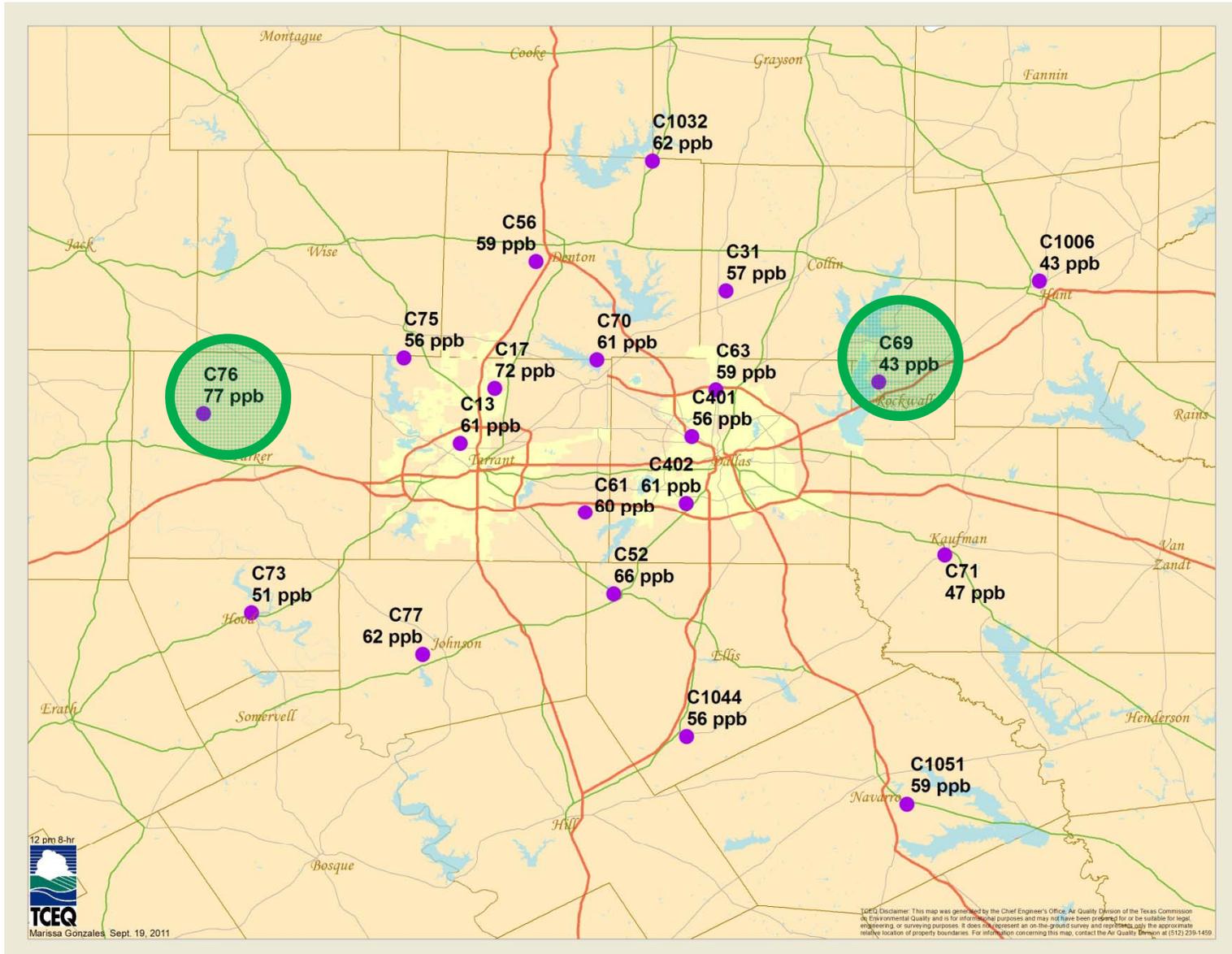
8-HOUR OZONE-MORTALITY COEFFICIENTS
RAW ESTIMATES AND 95% CONFIDENCE INTERVALS



Smith *et al.* (2009)



Air Monitors: 8-hr Ozone, 5:00 AM - 1:00 PM (CST)



Personal Exposure

At ambient air monitor



Dose is 100% of
Measured Concentration

Outdoors, under a tree



Dose is ~20-80% of
Measured Concentration

Indoors

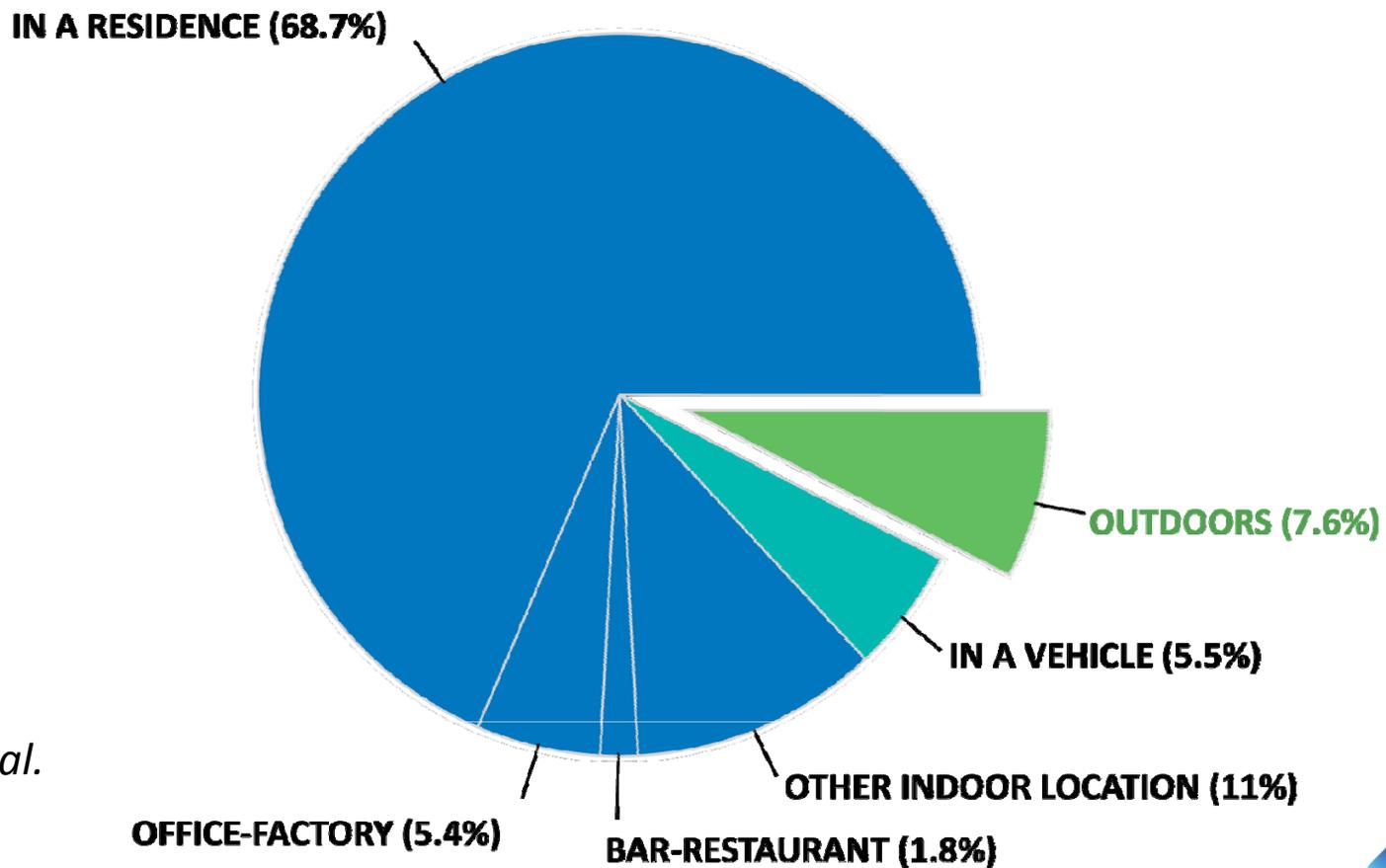


Dose is ~10% of
Measured Concentration

Time Spent Outdoors Impacts Interpretation of Epidemiology Studies

NHAPS - Nation, Percentage Time Spent

Total n = 9,196

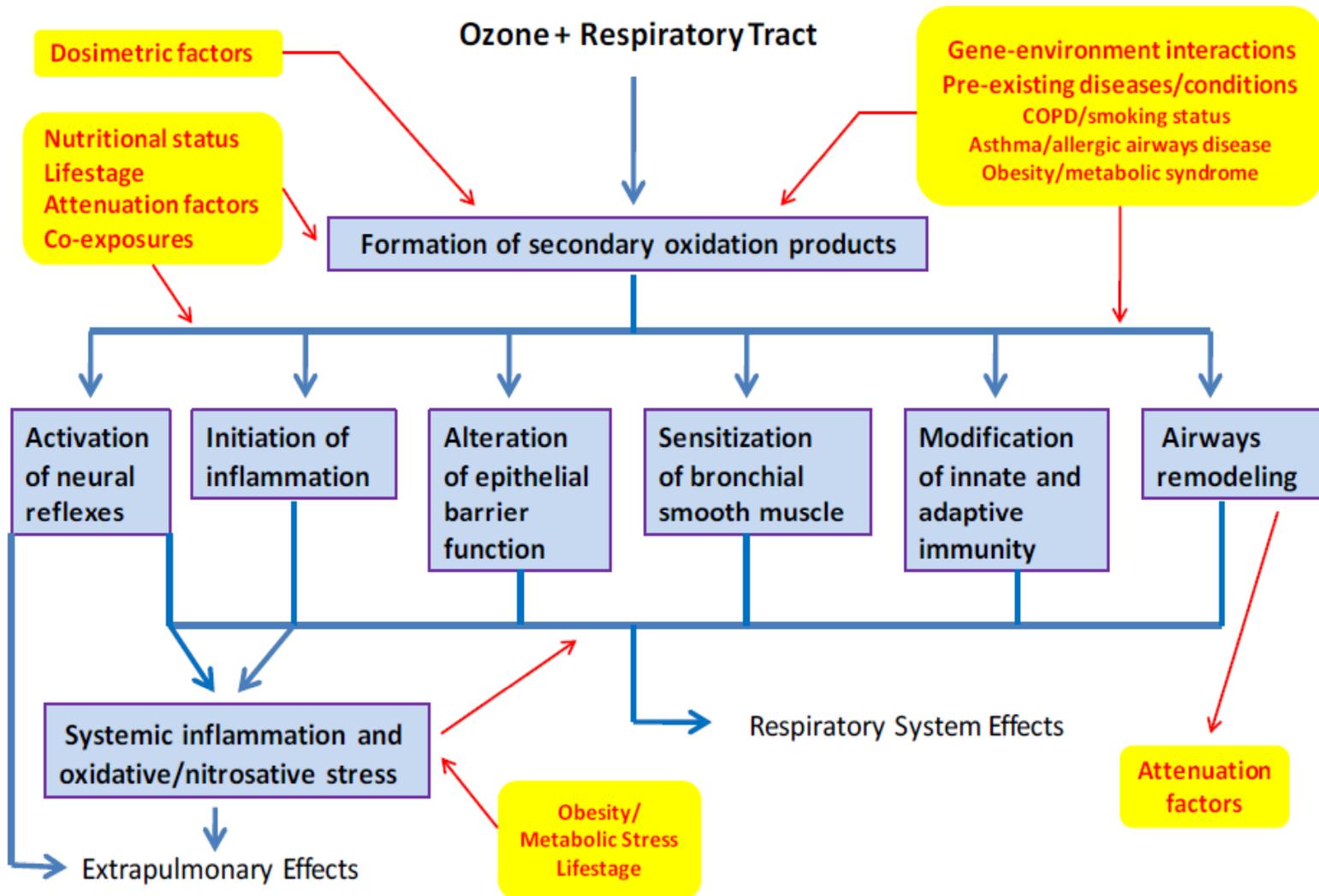


Klepeis *et al.*
(2001)

Short-term Exposures – Experimental Studies

- Animal studies reported mild effects at 100-200 ppb ozone
- Only one study reported airway hyper-responsiveness in three of nine rat species at low ozone exposures (Depuydt *et al.*, 1999)
 - Exposures of 50 ppb for 4 hours
 - No airway inflammation
 - EPA noted results should be confirmed in other species

Proposed Modes of Action for Ozone Respiratory Effects



US EPA (2013) ISA Figure 5-9

Long-term Exposure – Epidemiology Studies

- Few new studies; most show no association with cause-specific mortality
- EPA relies primarily on ACS cohort (Jerrett *et al.*, 2009)
 - **Decreases** in mortality from any cause, CV effects, and ischemic heart disease in models with PM_{2.5}
 - Demonstrates threshold

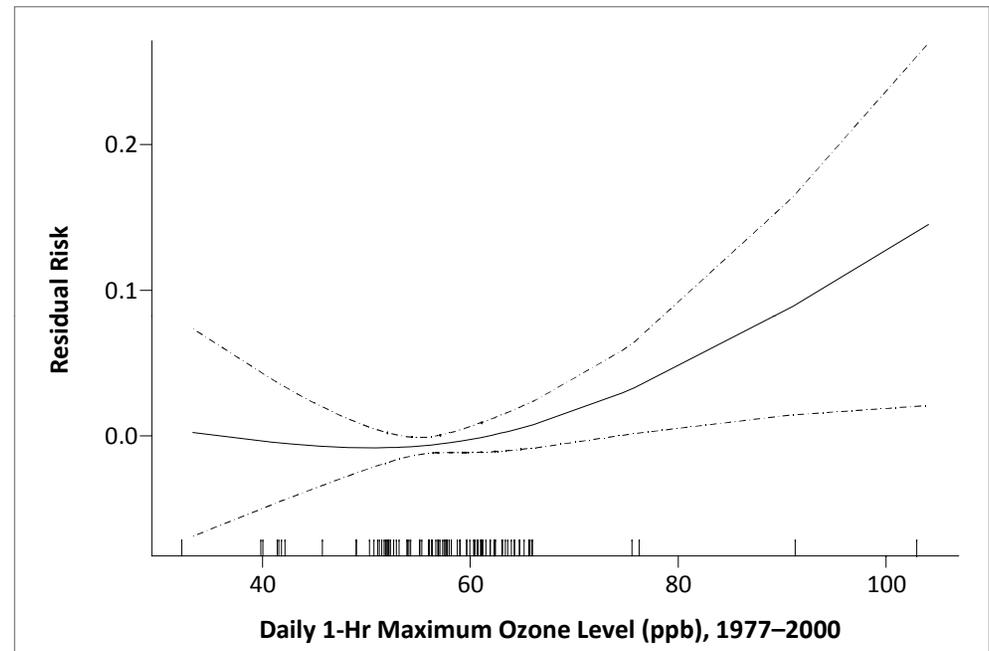
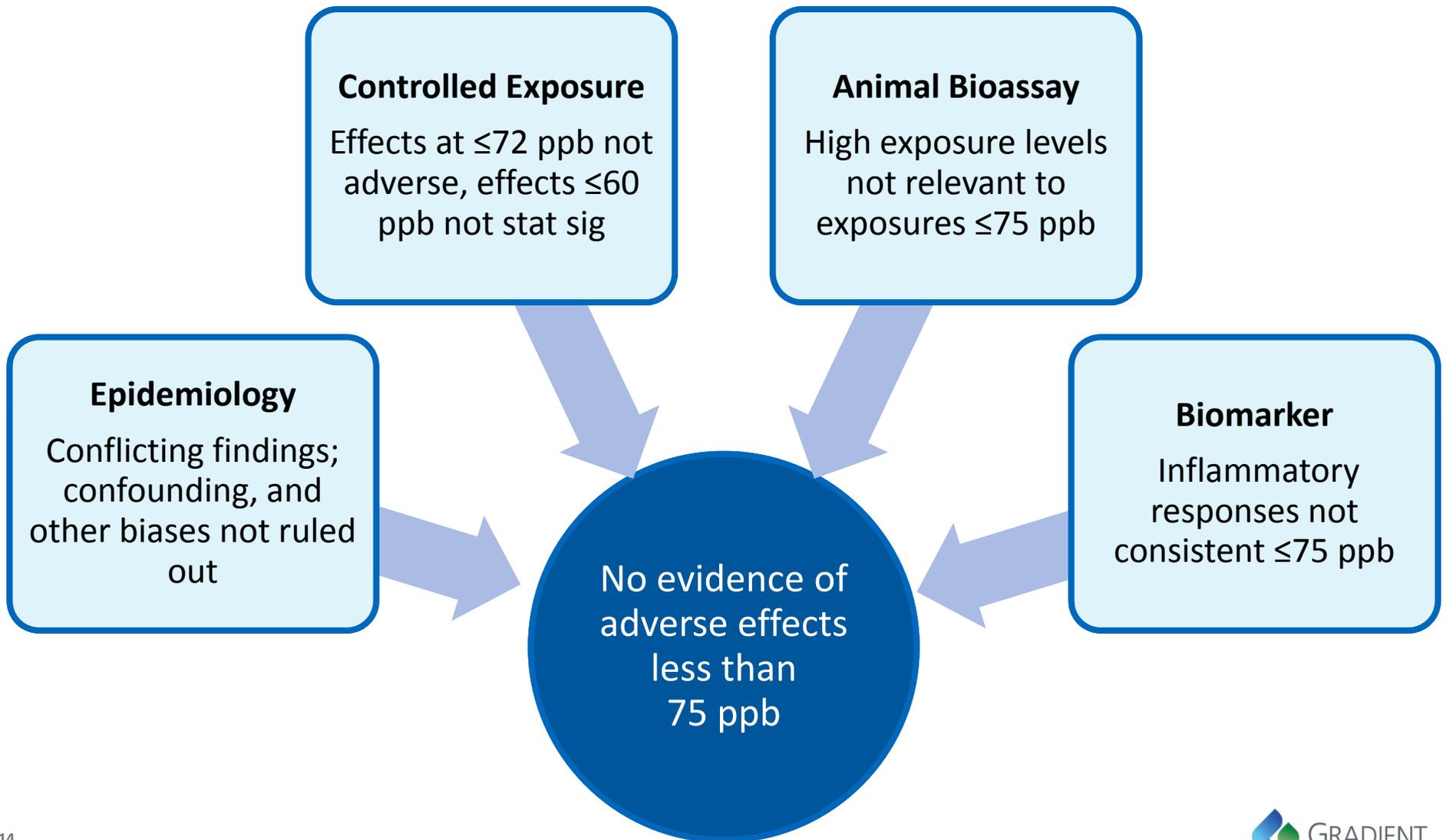


Figure 2. Exposure–Response Curve for the Relation between Exposure to Ozone and the Risk of Death from Respiratory Causes.

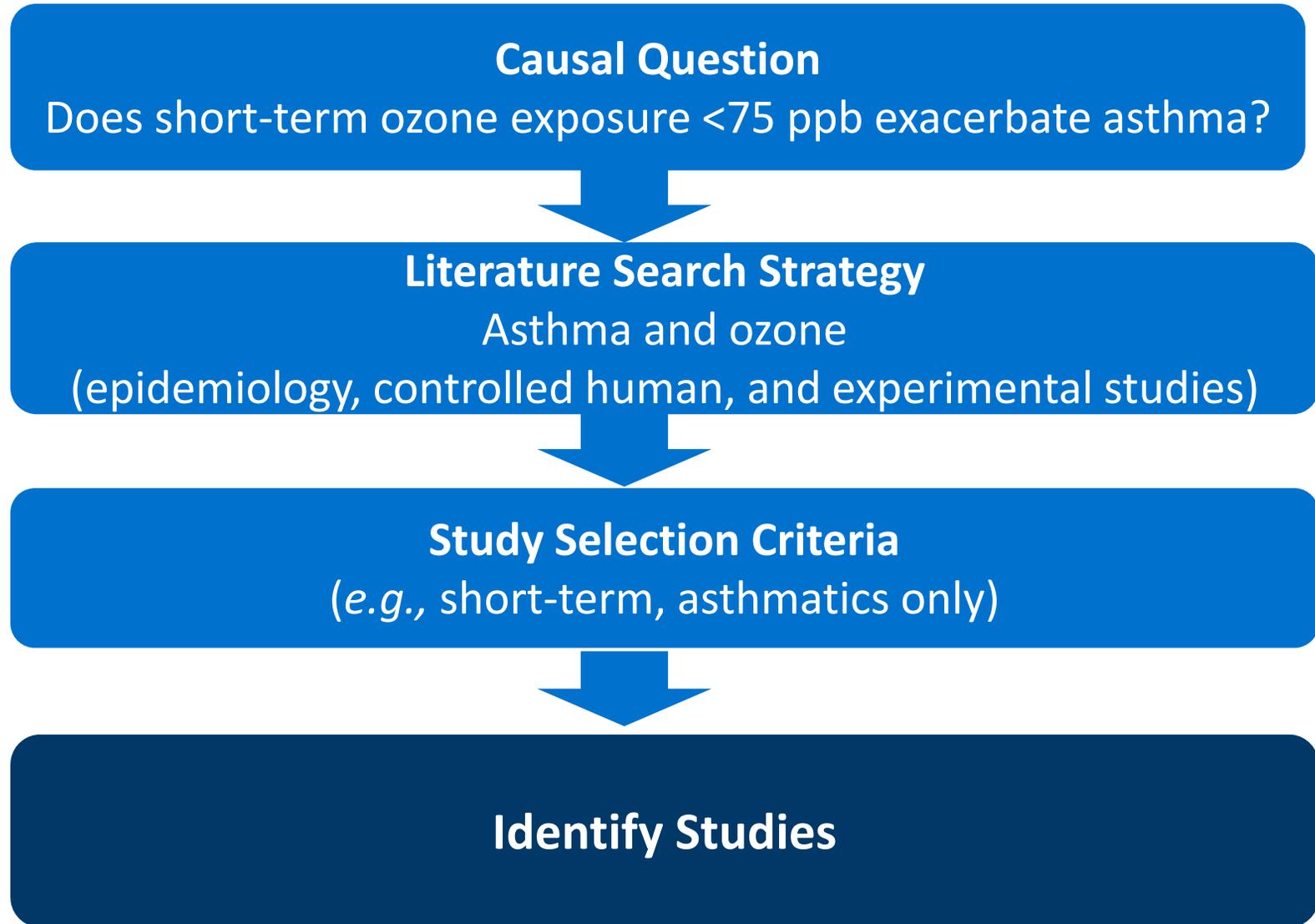
Little evidence for Respiratory Effects from Ozone Exposure less than 75 ppb



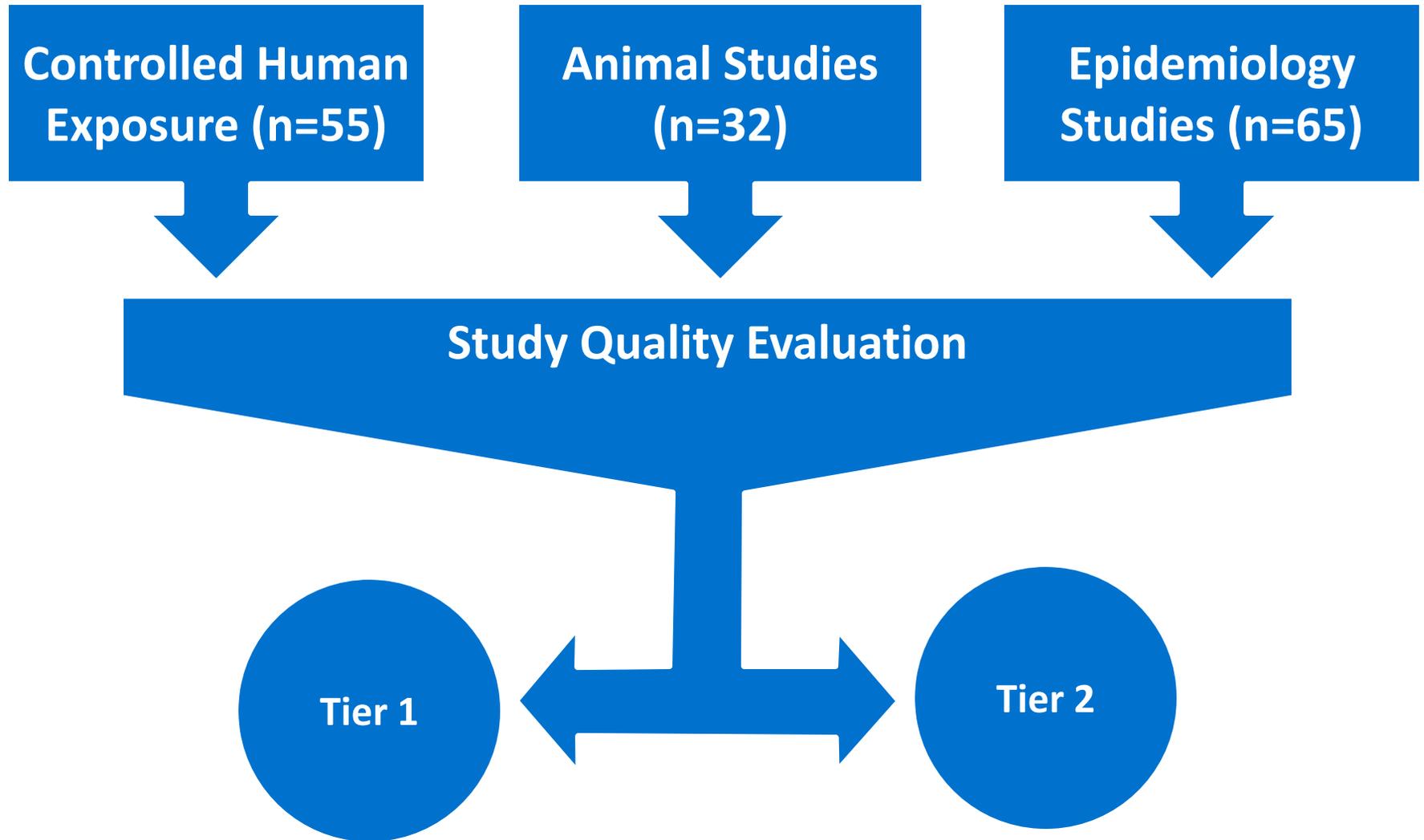
Ozone and Asthma

- EPA claims short-term increases in ambient ozone exposure increases respiratory symptoms and asthma medication use in children with asthma
- Epidemiology study results are inconsistent
- Controlled exposure studies reported inconsistent results in asthmatics at 160 to 400 ppb
- There is no good asthma model for studying effects of ozone in animals and studies use high ozone concentrations (> 300 ppb) that do not reflect relevant human exposures

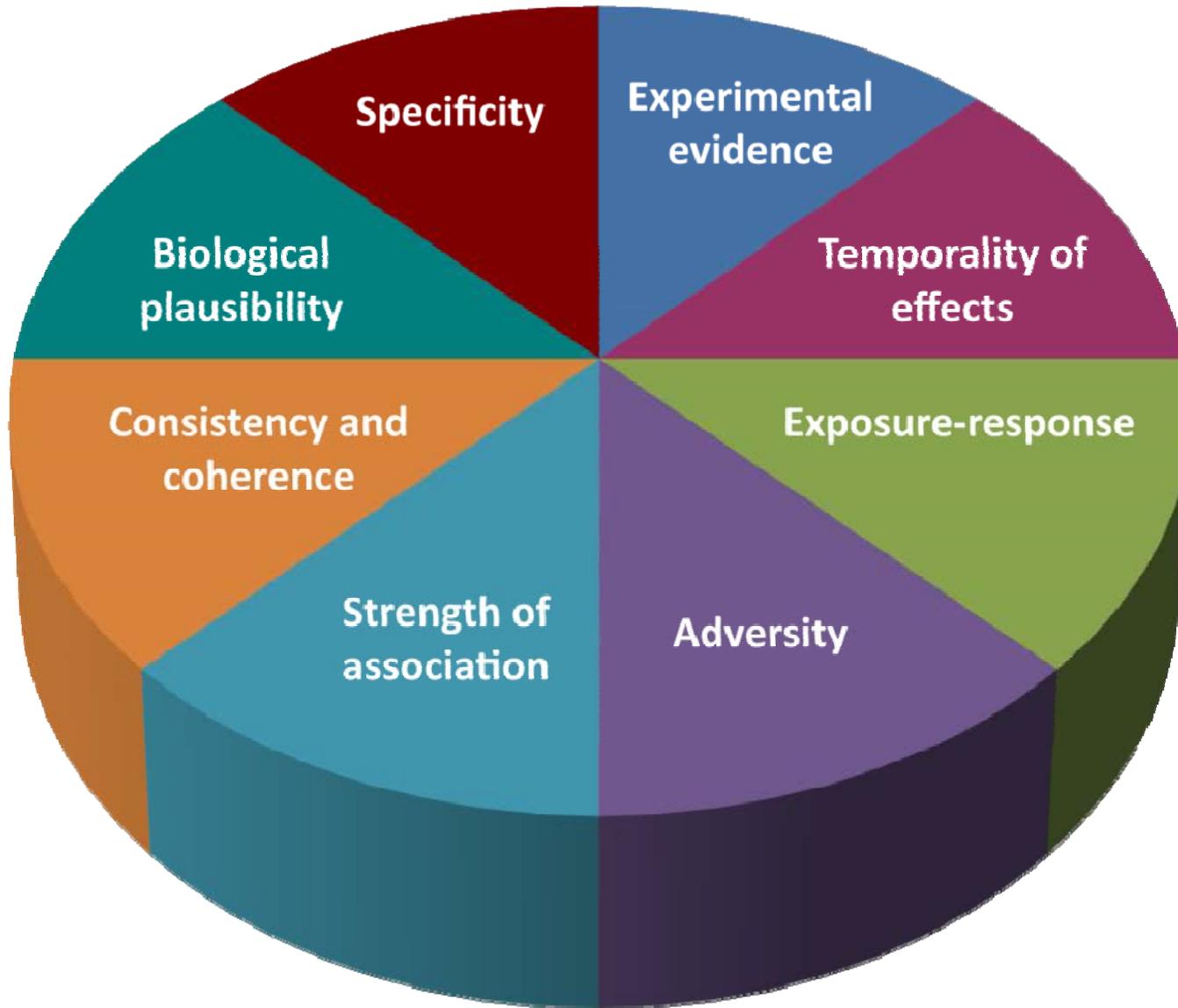
Short-term Ozone and Asthma



Short-term Ozone and Asthma



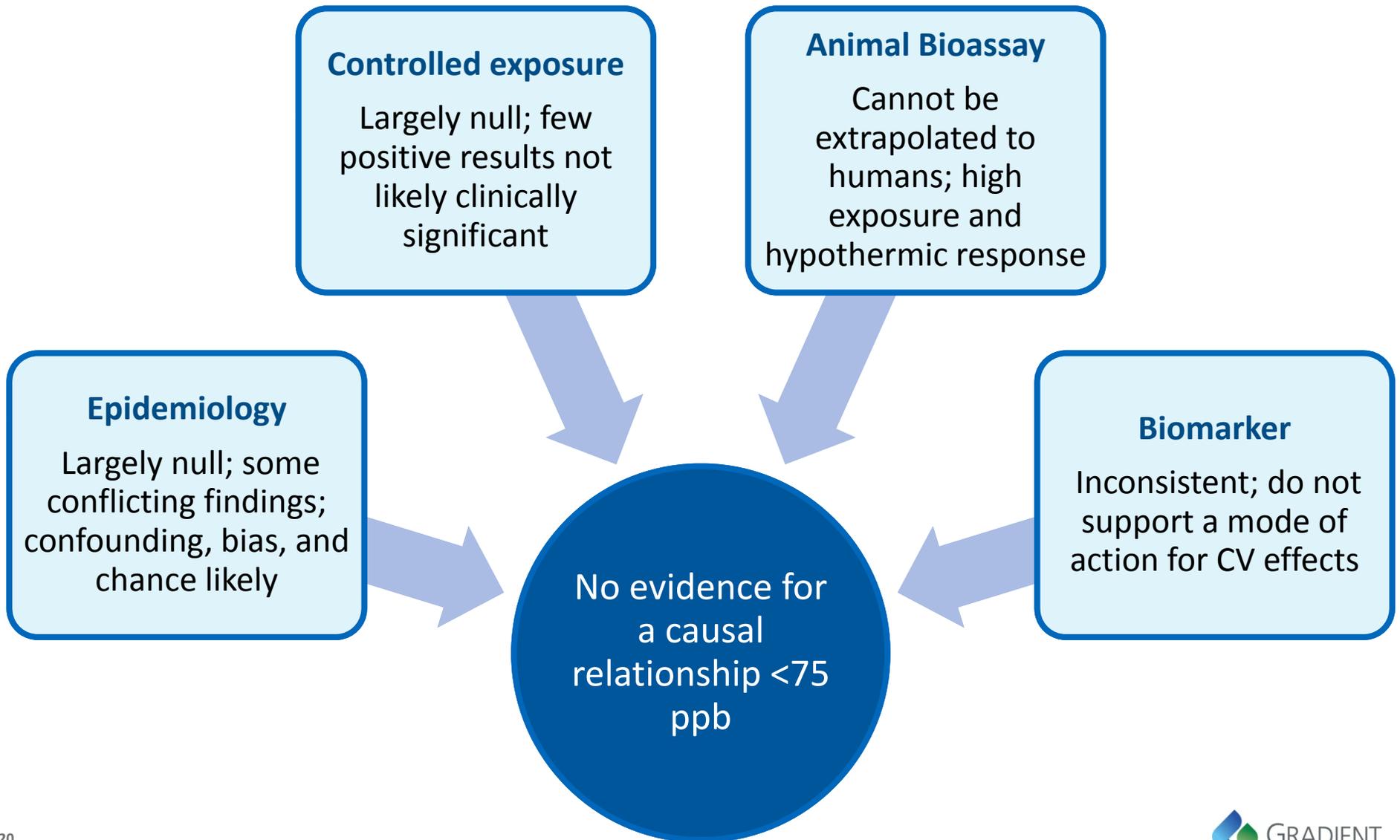
Short-term Ozone and Asthma Exacerbation



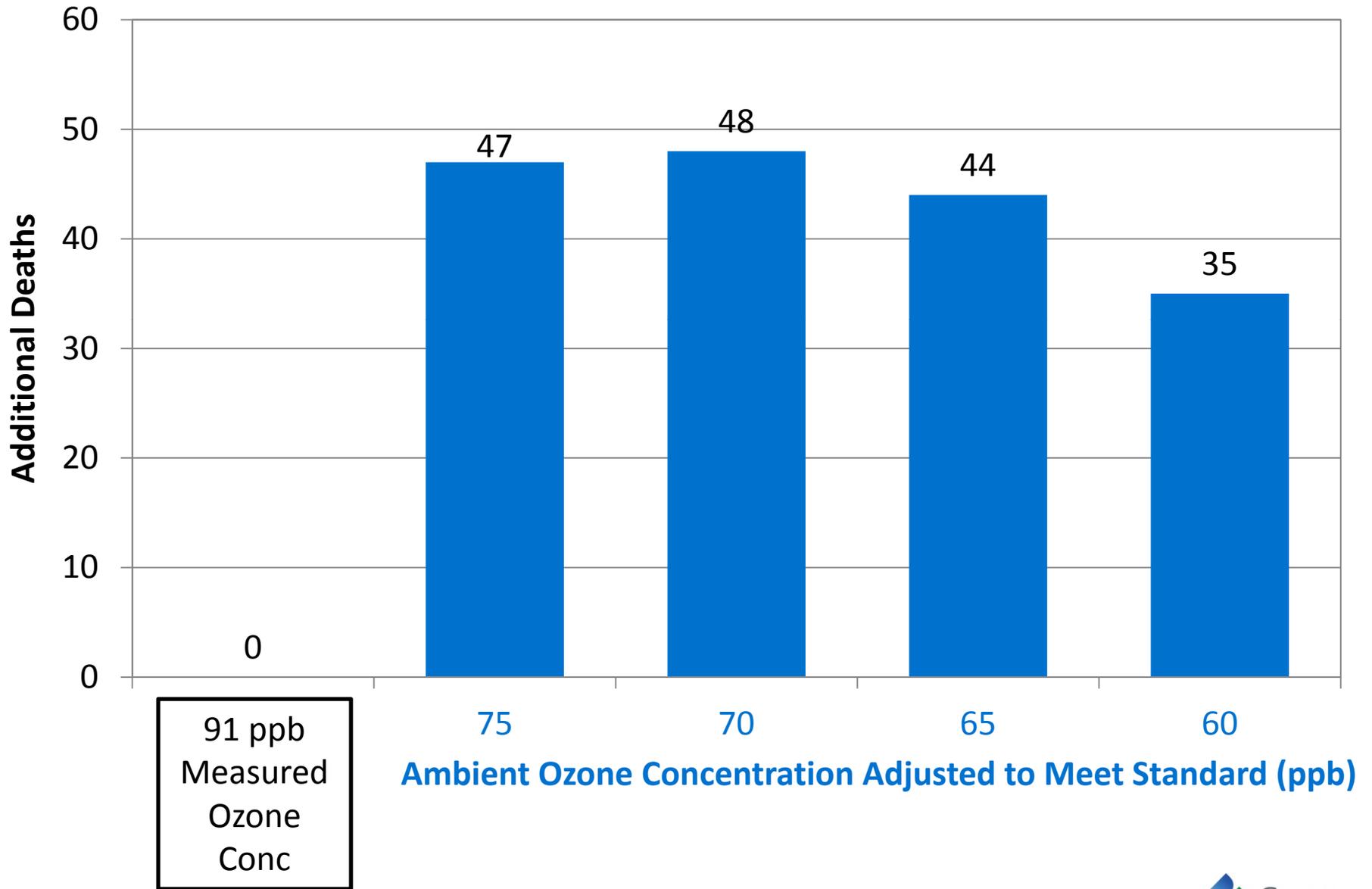
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Short-term Ozone and CV Effects



Impact of Ozone on Mortality – Houston, 2009



Main Issues

Issue	Outcome/Recommendation
Current ozone standard is health protective	Current standard should be presented as an option to Administrator
Layers of conservatism in analysis of proposed alternative standards	Health benefits overestimated
Presentation of results is sometimes misleading	Masks uncertainty
No statistical tests to compare benefits of alternative vs. current standard	Arbitrary interpretation of findings
Wide confidence intervals and many qualitative uncertainties	Benefits from alternative standards do not differ from those from current standard

Ozone Workshop 2015

- Provide policy makers with perspectives, insights, and information relevant to the upcoming ozone NAAQS decision that have not been the focus of other public deliberations
- Convene panels of experts to discuss scientific issues related to the ozone NAAQS within a multidisciplinary and policy-oriented context that is broader than CASAC takes on
- Revisit important aspects of the health and welfare effects evidence
- Discuss potential offsetting societal risks of a revised ozone NAAQS

Questions?

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