CT PM2.5 and Ozone Trends
and
PM NAAQS Review Update

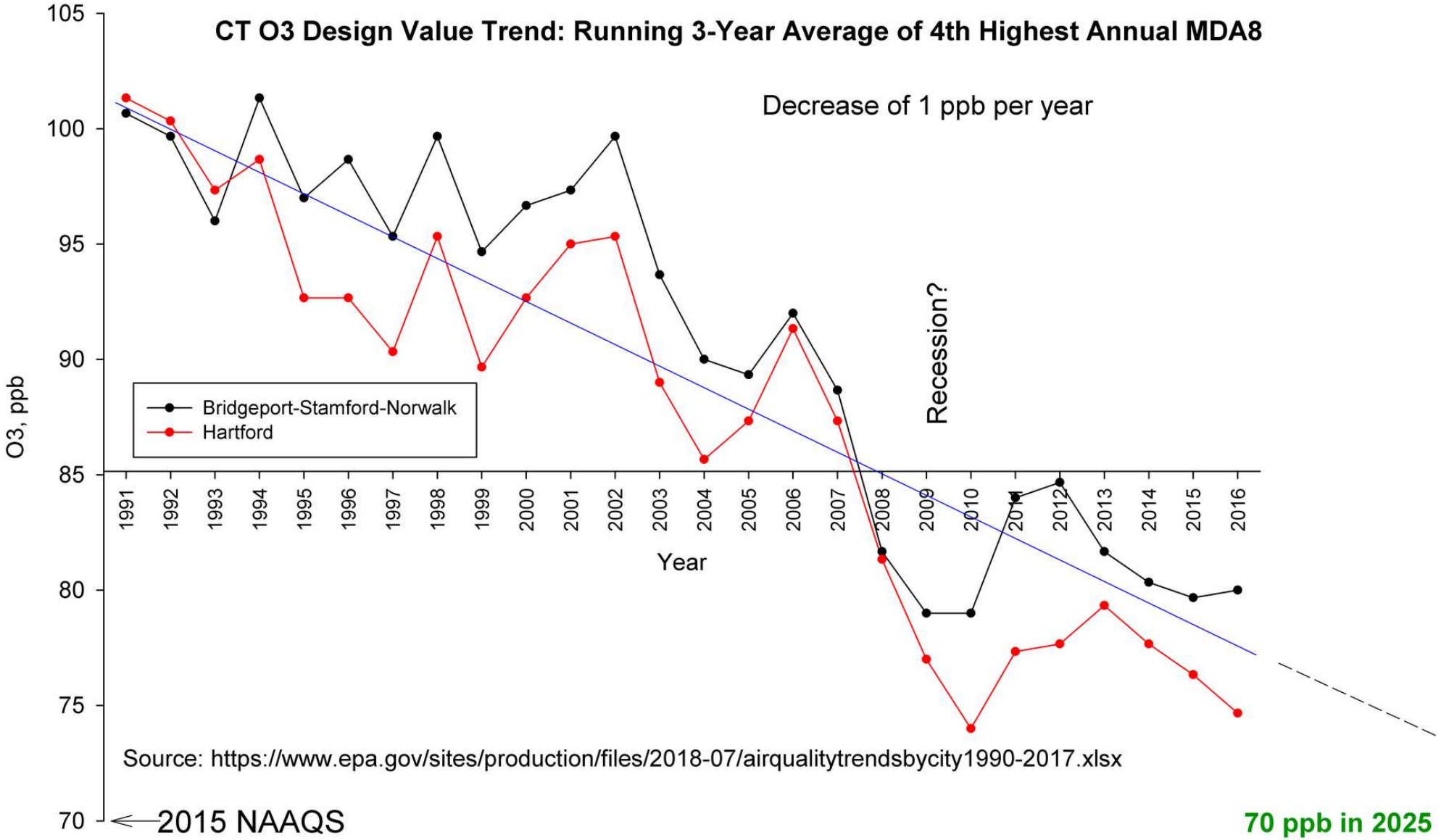
George Allen, NESCAUM

CT-DEEP SIPRAC
Hartford, CT September 13, 2018

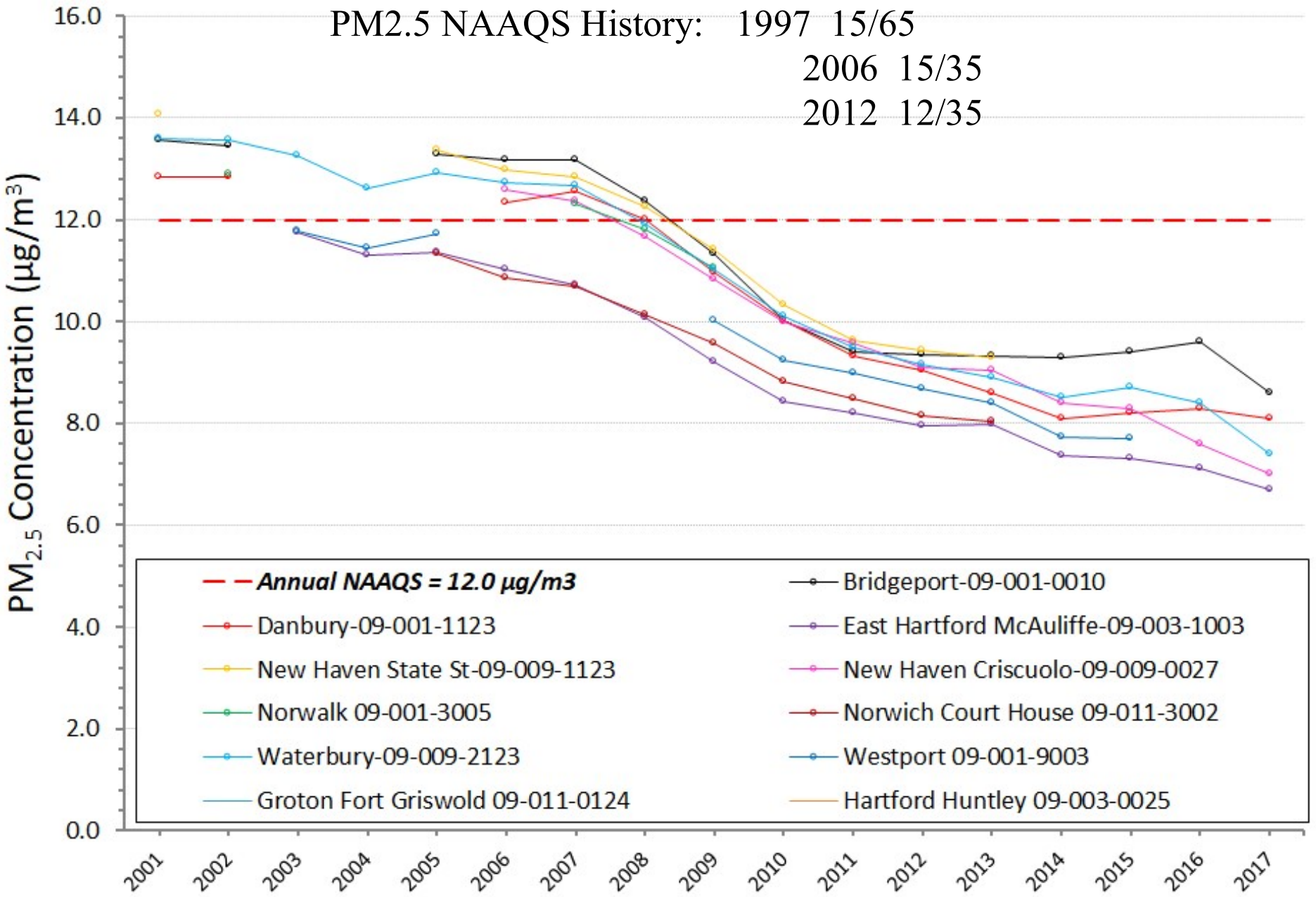
Please note you can hover over acronyms for the definitions through out this presentation.

Ozone and PM2.5 Trends, History of O3/PM NAAQS

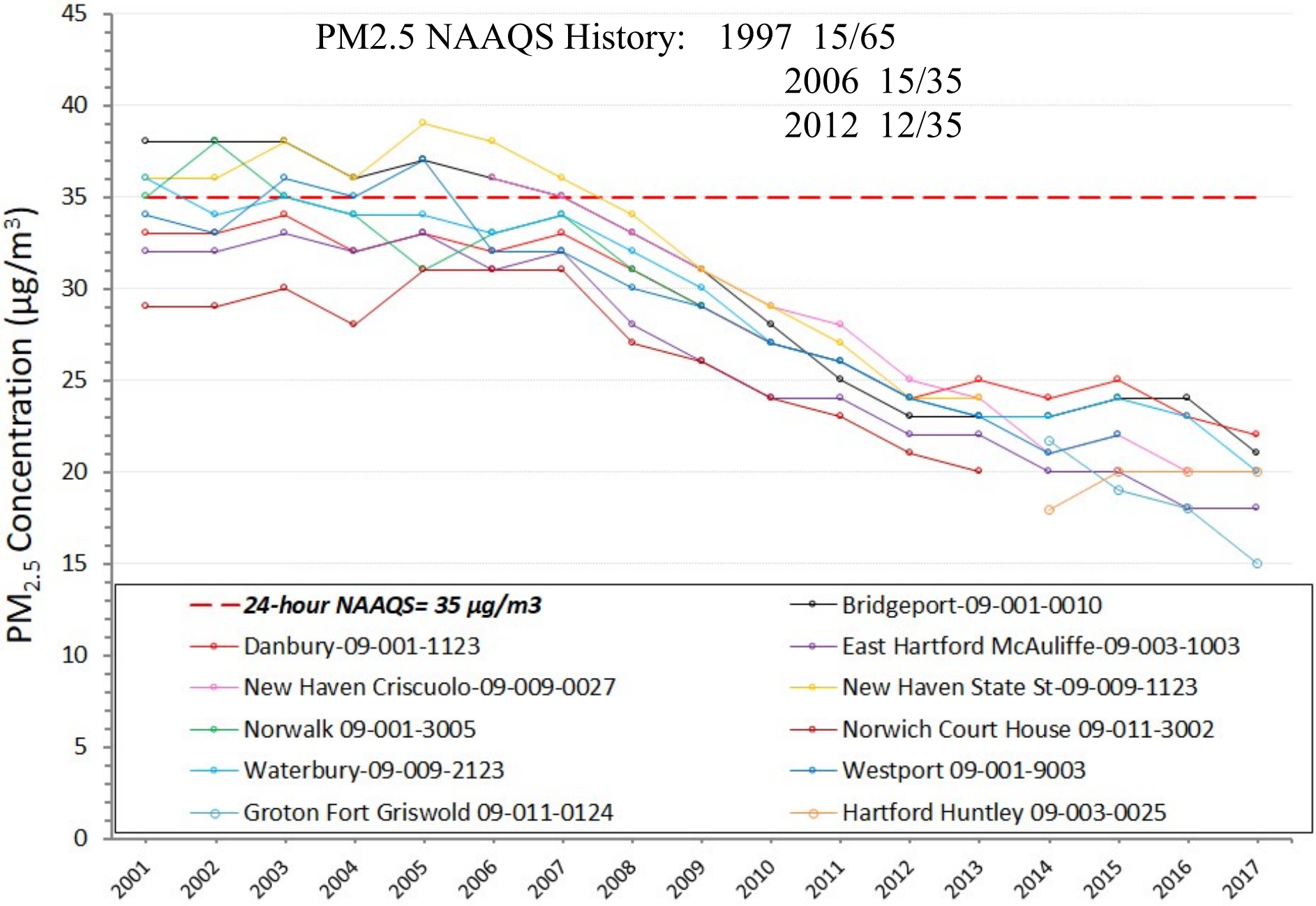
8h O3 NAAQS: 1997 0.08 ppm → 84 ppb or 0.084 ppm
2008 0.075 ppm
2015 0.070 ppm



CT Annual PM2.5 Trend



CT Daily PM2.5 Trend



Good progress, but...

The PM Cheese Has Been Moved!

(Again)

a Harvard School of Public Health research update

1. Continental US PM2.5 Exposure estimates:
High-resolution 1x1 km daily PM exposure modeling using AQS monitors, satellite AOD, land use regression, meteorology (mixing height, stability) and neural networks, with "leave one out" validation (Di et al., ES&T, 2016)

– PLUS --

2. 13 years (2000-2012) of medicare daily death data (22,567,924 deaths)

= Incredibly powerful PM mortality epidemiology analysis

Half a billion person-years of data

2 complementary analysis: chronic (annual) and acute (daily) exposures

For both PM2.5 and Ozone mortality

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 JUNE 29, 2017 VOL. 376 NO. 26

Chronic PM / Ozone Health Effects

Air Pollution and Mortality in the Medicare Population

Qian Di, M.S., Yan Wang, M.S., Antonella Zanobetti, Ph.D., Yun Wang, Ph.D., Petros Koutrakis, Ph.D., Christine Choirat, Ph.D., Francesca Dominici, Ph.D., and Joel D. Schwartz, Ph.D.

Table 2. Risk of Death Associated with an Increase of 10 μg per Cubic Meter in $PM_{2.5}$ or an Increase of 10 ppb in Ozone Concentration.*

Model	$PM_{2.5}$	Ozone
	hazard ratio (95% CI)	
Two-pollutant analysis		
Main analysis	1.073 (1.071–1.075)	1.011 (1.010–1.012)
Low-exposure analysis	1.136 (1.131–1.141)	1.010 (1.009–1.011)
Analysis based on data from nearest monitoring site (nearest-monitor analysis)†	1.061 (1.059–1.063)	1.001 (1.000–1.002)
Single-pollutant analysis‡	1.084 (1.081–1.086)	1.023 (1.022–1.024)

Risk of Death Associated with an Increase of 10 μg/m^3 PM2.5 by Study Subgroups: Chronic Effects

This is "hazard ratio", not relative risk; 1.00 = no elevated risk

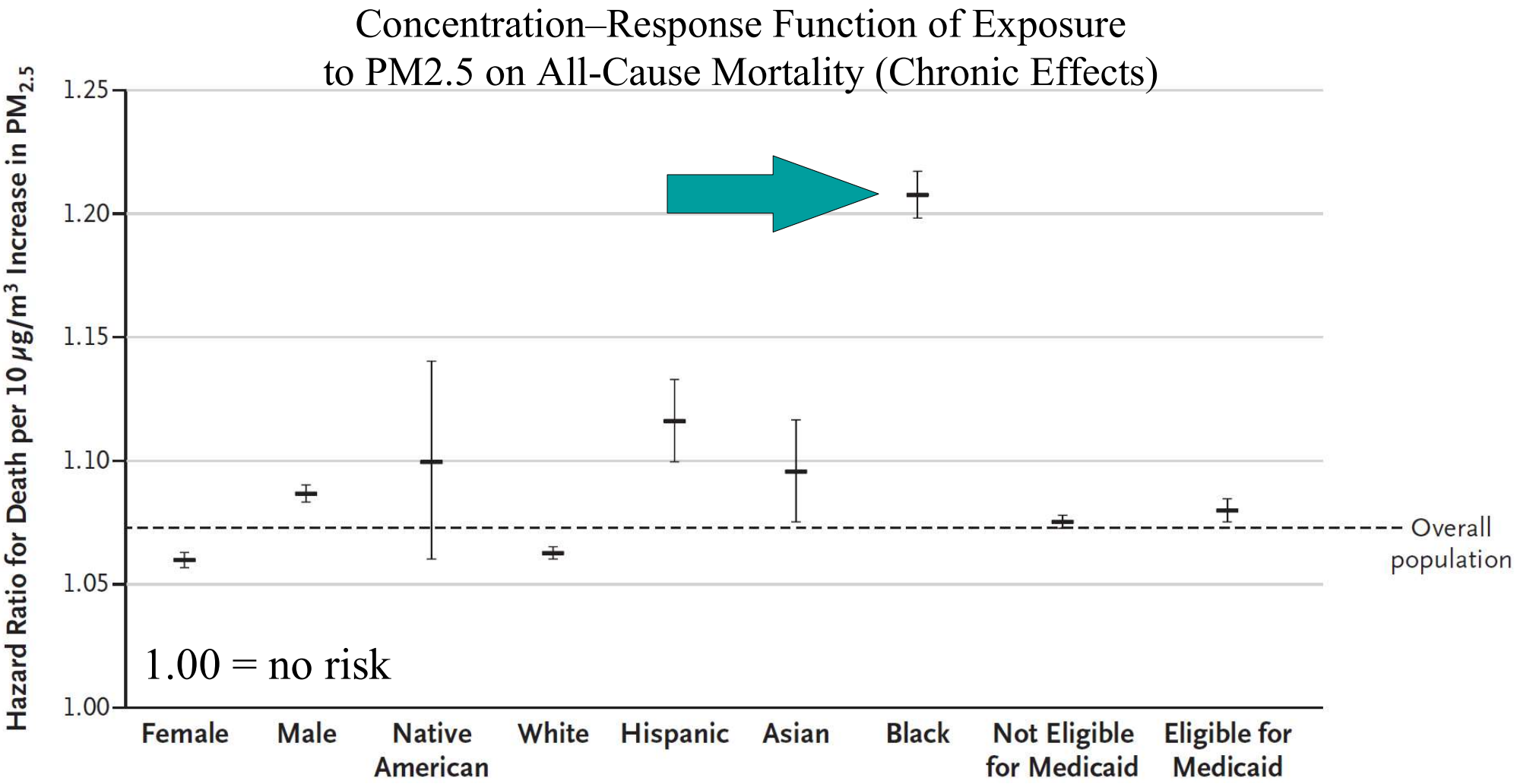
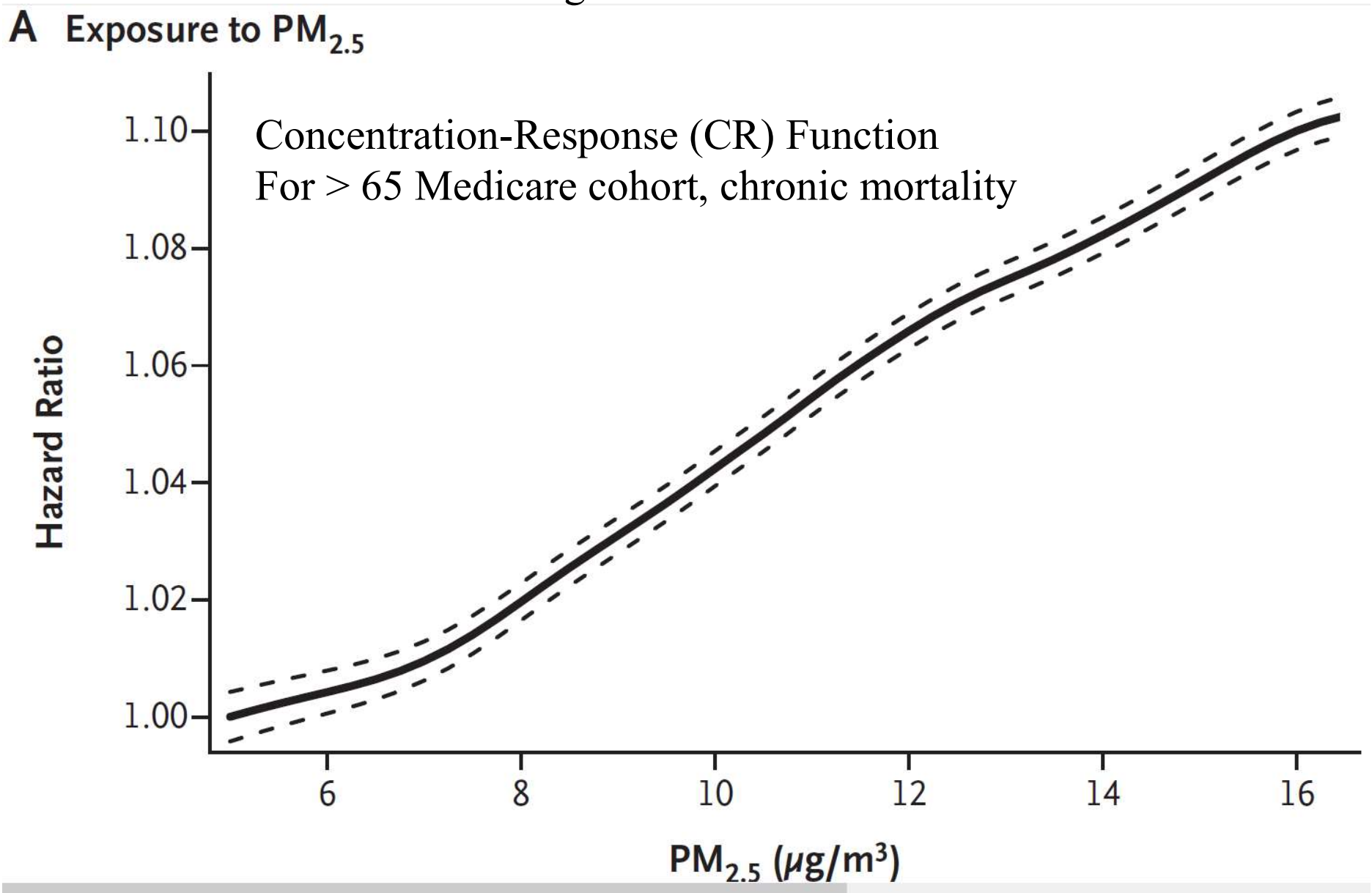


Figure 3A in Di et al.



Acute Effects, Dec. 26, 2017, JAMA:

JAMA | Original Investigation

Association of Short-term Exposure to Air Pollution With Mortality in Older Adults

Qian Di, MS; Lingzhen Dai, ScD; Yun Wang, PhD; Antonella Zanobetti, PhD; Christine Choirat, PhD; Joel D. Schwartz, PhD; Francesca Dominici, PhD

Table 2. Relative Risk Increase of Daily Mortality Associated With Each 10 μg/m^3 Increase in PM2.5 and Each 10-ppb Increase in Ozone

~~➔ percent RR, not HR; 0=no risk~~

	Relative Risk Increase, % (95% CI)	
Air Pollutant Analysis	$PM_{2.5}$	Ozone[b]
Main analysis[c]	1.05 (0.95-1.15)	0.51 (0.41-0.61)
Low-exposure analysis[d]	1.61 (1.48-1.74)	0.58 (0.46-0.70)
Single-pollutant analysis[e]	1.18 (1.09-1.28)	0.55 (0.48-0.62)
Nearest monitors analysis[f]	0.83 (0.73-0.93)	0.35 (0.28-0.41)

JAMA Discussion:

The Clean Air Act requires the administrator of the US EPA to set NAAQS at levels that provide protection for at-risk populations, "with an adequate margin of safety." In this study, Medicaid-eligible individuals, females, and elderly individuals had higher mortality rate increases associated with PM2.5 than other groups.

The current NAAQS for daily PM2.5 is 35 ug/m^3. When restricting the analysis to daily PM2.5 levels below 25 ug/m^3, the association between short-term PM2.5 exposure and mortality remained but was elevated.

The current daily NAAQS for ozone is 70 ppb; when restricting the analysis to daily warm-season ozone concentrations below 60 ppb, the effect size also increased slightly.

These results indicate that air pollution is associated with an increase in daily mortality rates, even at levels well below the current standards.

Chronic Exposure Study Take-Home, from an interview with the lead author of the HSPH studies:

If we would reduce the **annual average** of PM2.5 by just 1 microgram per cubic meter nationwide, we should save 12,000 lives among elder Americans every year; 5 micrograms: 63,817 lives every year.

Similarly, if we would reduce the **annual summer average** of ozone by just 1 ppb nationwide, we would save 1,900 lives every year; 5 ppb — 9537 lives.

Qian Di. Source:
https://medicalresearch.com/author-interviews/ozone-air-pollution-linked-to-us-deaths-even-at-levels-below-current-safety-standards/35650/

In other words...

EDITORIAL

Low-Level Air Pollution Associated With Death
Policy and Clinical Implications

Junfeng Zhang, PhD

JAMA December 26, 2017 Volume 318, Number 24

These and other very recent papers on PM mortality health effects are at https://tinyurl.com/pm-mortality (my google drive)

The 3 papers by Di are the ones mentioned in this presentation.
They are not based on "Secret Science".

Contents lists available at ScienceDirect
Environmental Research
journal homepage: www.elsevier.com/locate/envres

But wait, there's more!

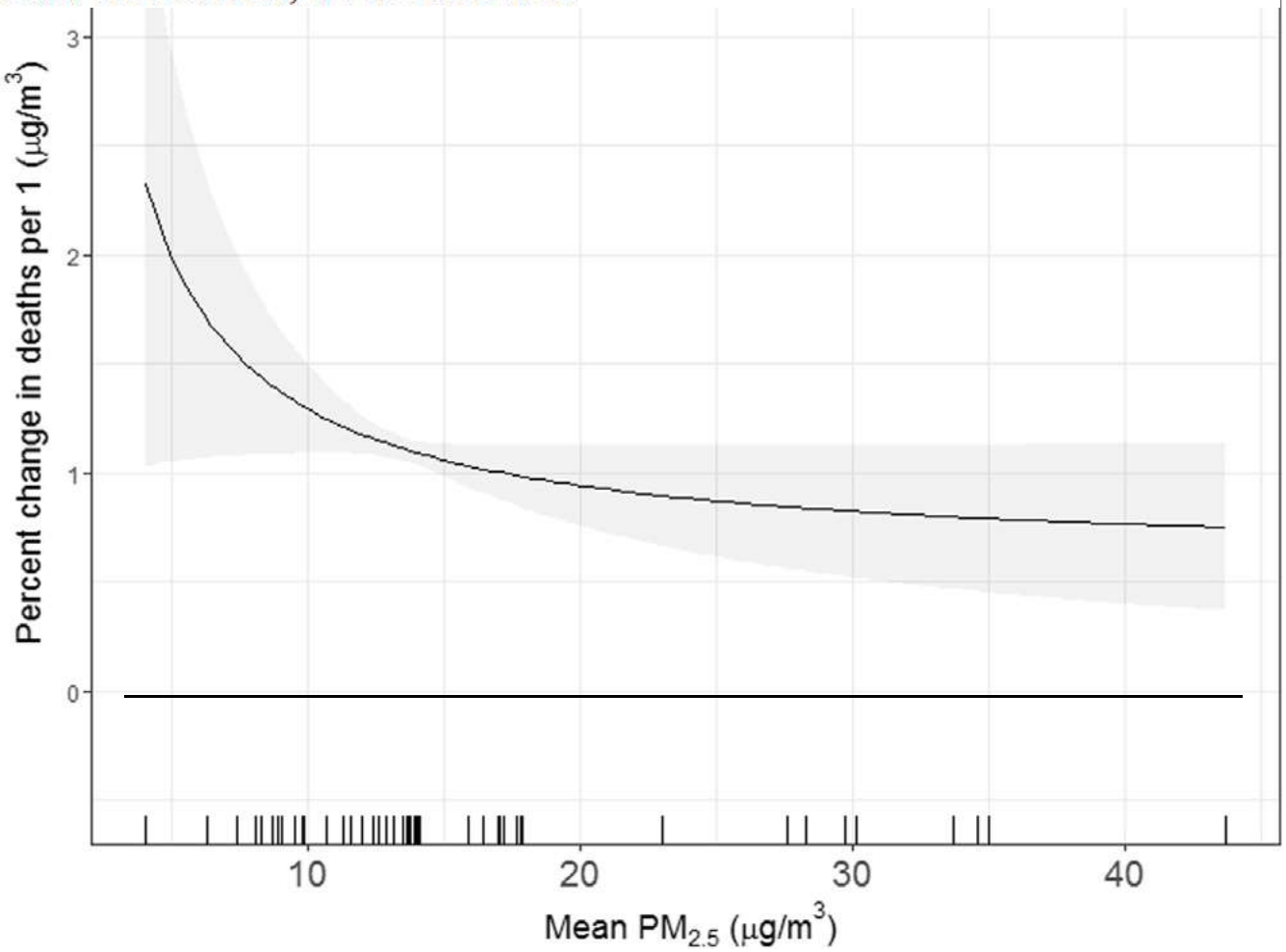
August, 2018

The concentration-response between long-term $PM_{2.5}$ exposure and mortality; A meta-regression approach

Alina Vodonos*, Yara Abu Awad, Joel Schwartz

Figure 1.

% change in deaths per 1 $\mu g/m^3$ PM2.5



PM NAAQS Review

Final PM Rule 12/14/2012: 12 annual / 35 daily

5-years: Last December

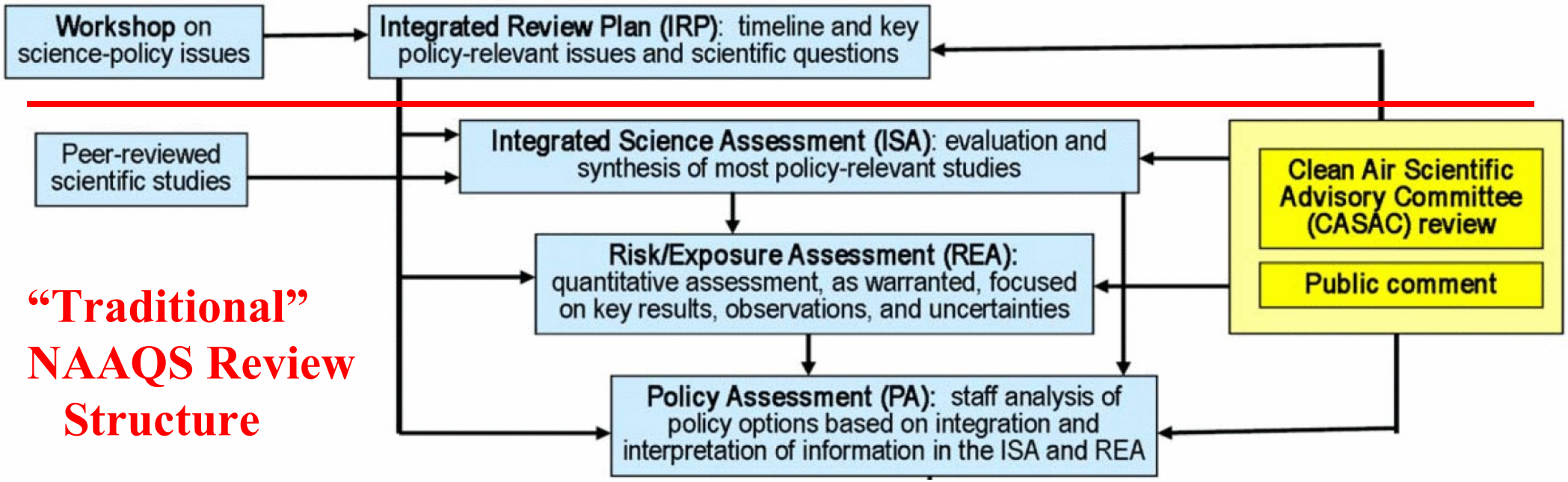
Status of Current Review

Workshop To Review Initial Draft Materials for the PM ISA: 6/2016

Integrated Review Plan completed: 12/2016

Next Step: First Draft of ISA (to be released "soon")

CASAC meeting to review: December 11-12, 2018



"Traditional" NAAQS Review Structure

But... This is not "business as usual"

CASAC members now prohibited from receiving EPA funding (COI.....)

For PM review: By next month, CASAC likely dominated by members more compliant w/ current administration objectives

"Secret Science" proposed rule?

Remove much of existing study literature from review

Wehrum: "Close Enough" rapid review approach?

Combined ISA/REA/PA "all at once"

Revised approach for handling "background concentrations"

To be finalized by end of 2020:

New O3 NAAQS expedited review

PM NAAQS review

?