GEORGIA
DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION DIVISION

CASAC Review of the PM and Ozone NAAQS

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AAPCA 2022 Spring Meeting
Salt Lake City, UT
April 28, 2022

Chartered CASAC Member: 2017 - present

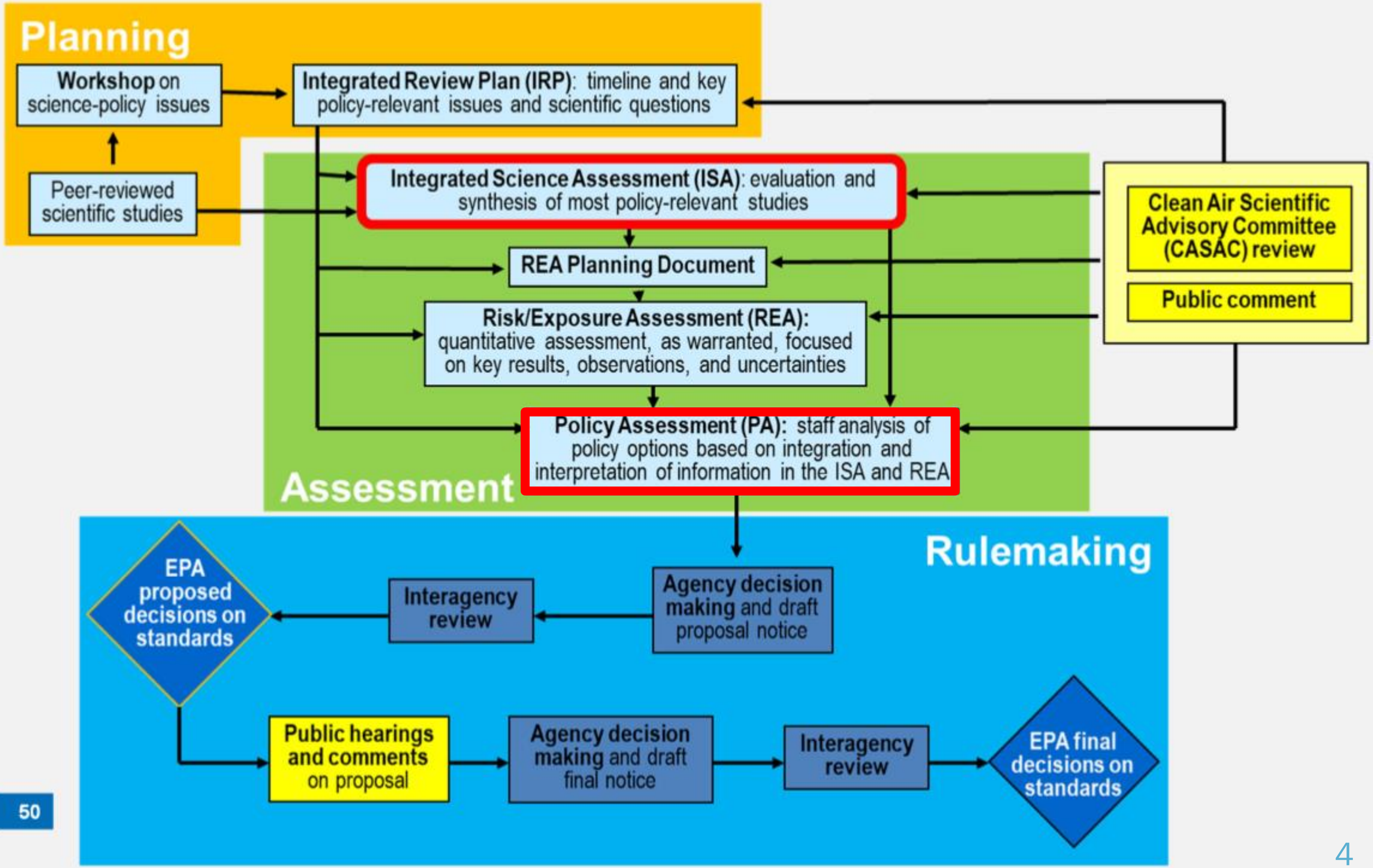
OUTLINE

- NAAQS Review Process
- CASAC NAAQS Reviews
- Previous PM and Ozone NAAQS Reviews
- Recent CASAC PM NAAQS Review
- Upcoming CASAC Ozone NAAQS Review

NAAQS REVIEW PROCESS

Traditional NAAQS Review Process

Overview of the NAAQS Review Process



CASAC
NAAQS REVIEWS

CASAC NAAQS REVIEWS

- Recently Completed NAAQS Reviews
  - PM Reconsideration
- Upcoming NAAQS Reviews
  - NOx, SOx, PM Ecological Effects
  - Lead
  - Ozone Reconsideration

PREVIOUS
PM and OZONE
NAAQS REVIEWS

2020 PM NAAQS REVIEW

Determination that the current standard is adequate:

PM Standard	EPA Preliminary/Final Conclusion	CASAC Final Conclusion*	EPA Administrator Final Decision
Annual $PM_{2.5}$	No	Yes (5), No (1)	Yes
Daily $PM_{2.5}$	Yes	Yes (6)	Yes
Daily PM_{10}	Yes	Yes (6)	Yes
Secondary $PM_{2.5}$	Yes	Yes (6)	Yes

*Numbers in parenthesis represent the number of CASAC members drawing each conclusion.

2020 OZONE NAAQS REVIEW

Determination that the current standard is adequate:

Ozone Standard	EPA Preliminary/Final Conclusion	CASAC Final Conclusion*	EPA Administrator Final Decision
Primary Ozone	Yes	Yes (6), No (1)	Yes
Secondary Ozone	Yes	Yes (7)	Yes

*Numbers in parenthesis represent the number of CASAC members drawing each conclusion.

RECENT CASAC PM NAAQS REVIEW

CURRENT CHARTERED CASAC

- Dr. Elizabeth A. (Lianne) Sheppard (Chair) – Professor
  - University of Washington
- Dr. James Boylan – Assistant Branch Chief
  - Georgia Department of Natural Resources
- Dr. Mark Frampton – Professor Emeritus
  - University of Rochester Medical Center
- Dr. Michelle Bell – Professor
  - Yale University
- Dr. Judith C. Chow – Research Professor
  - Desert Research Institute
- Dr. Christina H. Fuller – Associate Professor
  - Georgia State University
- Dr. Alexandra Ponette-González – Associate Professor
  - University of North Texas

RECENT CASAC PM PANEL

1. Dr. Lianne Sheppard (Chair) – University of Washington
2. Dr. Peter Adams – Carnegie Mellon University
3. Mr. George Allen – Northeast States for Coordinated Air Use Management
4. Dr. John Balmes – University of California, San Francisco
5. Dr. Michelle Bell – Yale University School of the Environment
6. Dr. James Boylan – Georgia Department of Natural Resources
7. Dr. Judith Chow – Desert Research Institute
8. Dr. Jane Clougherty – Drexel University
9. Dr. Deborah Cory-Slechta – University of Rochester
10. Dr. Mark Frampton – University of Rochester Medical Center
11. Dr. Christina Fuller – Georgia State University School of Public Health
12. Dr. Terry Gordon – New York University School of Medicine
13. Dr. Michael Kleinman – University of California, Irvine
14. Dr. Stephanie Lovinsky-Desir – Columbia University
15. Dr. Jennifer Peel – Colorado State University
16. Dr. Alexandra Ponette-González – University of North Texas
17. Dr. David Rich – University of Rochester Medical Center
18. Dr. Jeremy Sarnat – Emory University
19. Dr. Neeta Thakur – University of California at San Francisco
20. Dr. Barbara Turpin – University of North Carolina at Chapel Hill
21. Dr. Marc Weisskopf – Harvard T.H. Chan School of Public Health
22. Dr. Corwin Zigler – University of Texas at Austin

CASAC ISA REVIEW

- **Draft Supplement to the 2019 Integrated Science Assessment (ISA)**
  - This builds upon the 2019 Final PM ISA
  - Does not reevaluate causal determinations
  - Focus on “causal” relationships
    - Short- and long-term $PM_{2.5}$ exposure and cardiovascular effects
    - Short- and long-term $PM_{2.5}$ exposure and mortality
- **CASAC Deliverables**
  - Letter to EPA Administrator (March 18, 2022)
    - Consensus Response to Charge Questions
    - Individual CASAC Comments

CAUSAL DETERMINATION FRAMEWORK

	Health Effects	Ecological and Other Welfare Effects	
Causal relationship	Evidence is sufficient to conclude that there is a causal relationship with relevant pollutant exposures (e.g., doses or exposures generally within one to two orders of magnitude of recent concentrations). [illegible] been shown to result in health effects in studies in which chance, confounding, and other biases could be ruled out with [illegible] (1) controlled human exposure studies that demonstrate consistent effects, or (2) observational studies that cannot be [illegible] that are supported by other lines of evidence (e.g., animal studies or mode of action information). Generally, the determination is based on multiple high-quality studies conducted by multiple research groups.	Evidence is sufficient to conclude that there is a causal relationship with relevant pollutant exposures. That is, the pollutant has been shown to result in [illegible] in which chance, confounding, and other biases could be ruled out with reasonable confidence. Controlled exposure studies (laboratory [illegible] studies) provide the strongest evidence for causality, but the scope of inference may be limited. Generally, the [illegible] on multiple studies conducted by multiple research groups, and evidence that is considered sufficient to infer a causal relationship is usually obtained from the joint consideration of many lines of evidence that reinforce each other.	Multiple, high-quality studies Rule out chance, confounding, and other biases with reasonable confidence
Likely to be a causal relationship	Evidence is sufficient to conclude that a causal relationship is likely to exist with relevant pollutant exposures. That is, the pollutant has been shown to result in health effects in studies where results are not explained by chance, confounding, and other biases, but uncertainties [illegible] For example: (1) observational studies show an association, but copollutant exposures are difficult to address and/or other [illegible] human exposure, animal, or mode of action information) are limited or inconsistent, or (2) animal toxicological evidence from multiple studies from different laboratories demonstrate effects, but limited or no human data are available. Generally, the determination is based on multiple high-quality studies.	Evidence is sufficient to conclude that there is a likely causal association with relevant pollutant exposures. That is, an association has been observed between the pollutant and the outcome in studies in which chance, [illegible] other biases are minimized but uncertainties remain. For example, field studies show a relationship, but suspected interacting factors [illegible] and other lines of evidence are limited or inconsistent. Generally, the determination is based on multiple studies by multiple research groups.	Multiple, high-quality studies Important uncertainties remain
Suggestive of, but not sufficient to infer, a causal relationship	Evidence is suggestive of a causal relationship with relevant pollutant exposures but is limited, and chance, confounding, and other biases cannot be ruled out. For example: (1) when the body of evidence is relatively small, at least one high-quality epidemiologic study shows an association with a given health outcome and/or at least one high-quali[illegible] effects relevant to humans in animal species, or (2) when the body of evidence is relatively large, evidence from studies of varying quality is generally supportive but not entirely consistent, and there may be coherence across lines of evidence (e.g., animal studies or mode of action information) to support the determination.	Evidence is suggestive of a causal relationship with relevant pollutant exposures, but chance, confounding, and other biases cannot be ruled out. For example, at least one high-quality study shows an effect, but the results of other studies are inconsistent.	Evidence is suggestive but limited
Inadequate to infer a causal relationship	Evidence is inadequate to determine that a causal relationship exists with relevant pollutant exposures. The avai[illegible] quality, consistency, or statistical power to permit a conclusion regarding the presence or absence of an effect.	Evidence is inadequate to determine that a causal relationship exists with [illegible] The available studies are of insufficient quality, consistency, or statistical power to permit a conclusion regarding the presence [illegible]	Evidence is of insufficient quantity, quality, consistency, or statistical power
Not likely to be a causal relationship	Evidence indicates there is no causal relationship with relevant pollutant exposures. Several adequate studies, co[illegible] exposure that human beings are known to encounter and considering at-risk populations and lifestages, are mutually consistent in [illegible] any level of exposure.	Evidence indicates there is no causal relationship with relevant pollutant exposures. Several adequate studies examining relationships with relevant exposures are consistent in failing to show an effect at any level of exposure.	Multiple studies show no effect across exposure concentrations

EPA's causal determination framework is based on WOE and professional judgement.

CASAC ISA COMMENTS

- This background should include a summary of the previous CASAC's consideration of the causal determination framework, and its recommendation that a "more explicit, systematic, and transparent process" be used for determining causal relationships.
- This recommendation resulted in the National Academies of Sciences, Engineering, and Medicine (NASEM) committee on "Assessing Causality from a Multidisciplinary Evidence Base for National Ambient Air Quality Standards," which is currently in deliberations.

ISA Supplement - CASAC Response to Charge Questions, page 3.

CASAC ISA LETTER

- Although continued refinements to the current weight-of-evidence (WOE) causal determination framework are possible, the CASAC unanimously supports the use of the current WOE causal determination framework, as described in the 2015 Preamble to the ISA, for this review and strongly believes that this framework should not be replaced without a comprehensive evaluation of alternatives.

ISA Supplement - CASAC Letter to the EPA Administrator, page 2.

United States Environmental Protection Agency

PM ISA: 2018 DRAFT vs. 2019 FINAL

HUMAN HEALTH EFFECTS

Health Outcome		ISA / Indicator	Current PM Draft ISA $PM_{2.5}$	$PM_{10-2.5}$	UFP
Respiratory		Short-term exposure			
		Long-term exposure			
Cardiovascular		Short-term exposure			
		Long-term exposure		*	
Metabolic		Short-term exposure	*	*	*
		Long-term exposure	*	*	*
Nervous System		Short-term exposure	*		*
		Long-term exposure	CASAC? *	*	CASAC? *
Reproductive	Male/Female Reproduction and Fertility	Long-term exposure			
	Pregnancy and Birth Outcomes	Long-term exposure			
Cancer		Long-term exposure	CASAC? *	*	
Mortality		Short-term exposure			
		Long-term exposure		*	

Causal | Likely causal | Suggestive | Inadequate

* = new determination or change in causality determination from 2009 PM ISA

HUMAN HEALTH EFFECTS

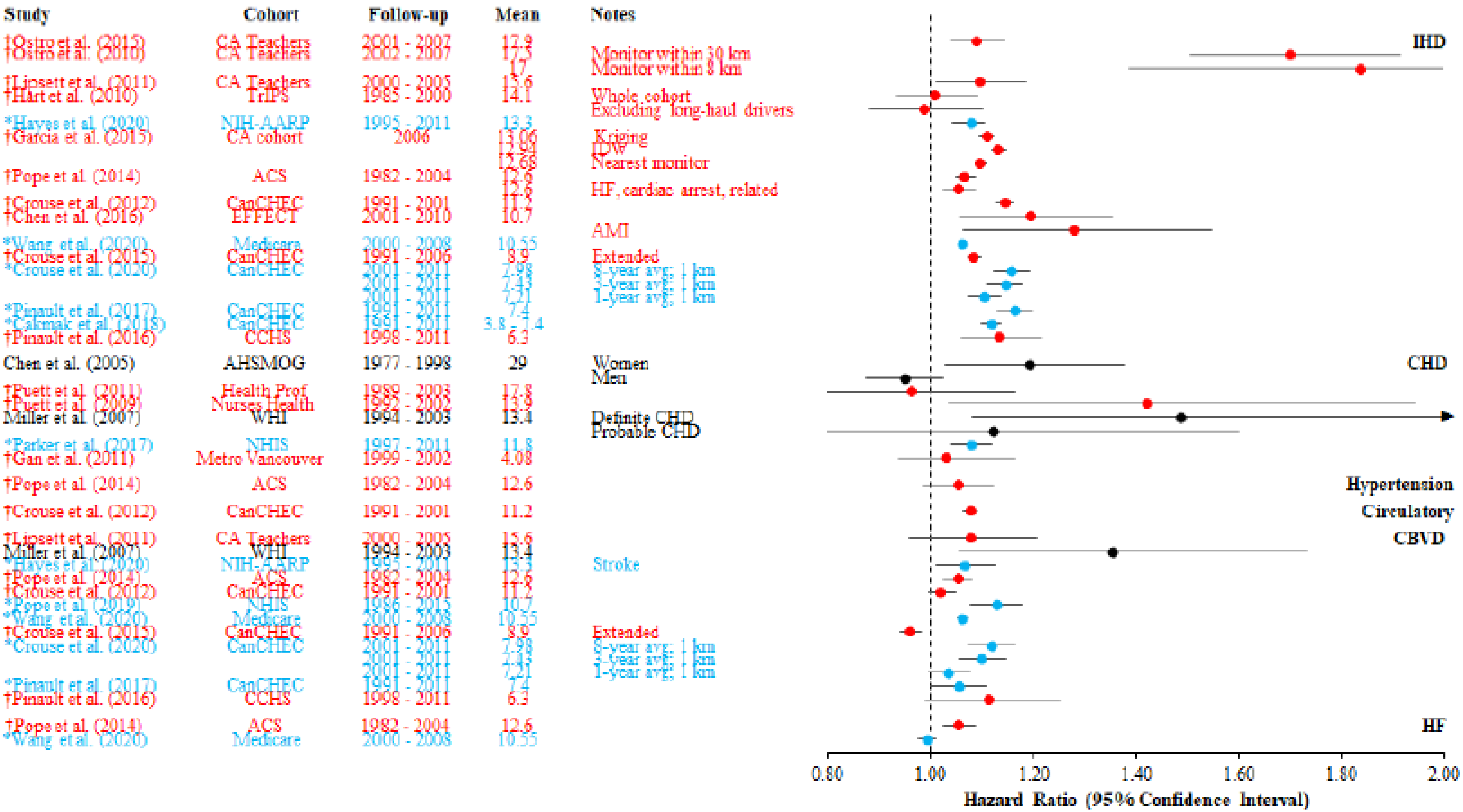
Health Effect Category		ISA / Indicator	Final PM ISA $PM_{2.5}$	$PM_{10-2.5}$	UFP
Respiratory		Short-term exposure			
		Long-term exposure			
Cardiovascular		Short-term exposure			
		Long-term exposure		▲	
Metabolic		Short-term exposure	*	*	*
		Long-term exposure	*	*	*
Nervous System		Short-term exposure	▲		▲
		Long-term exposure	*	*	Update *
Reproductive	Male/Female Reproduction and Fertility	Long-term exposure			
	Pregnancy and Birth Outcomes	Long-term exposure			
Cancer		Long-term exposure	▲	▲	
Mortality		Short-term exposure			
		Long-term exposure		▲	

Causal | Likely causal | Suggestive | Inadequate

* = no evidence to evaluate in 2009 PM ISA

▲ = change in causality determination from 2009 PM ISA

LONG-TERM $PM_{2.5}$ EXPOSURE



2009 PM ISA 2019 PM ISA New Studies

Figure 3-23 **Associations between long-term $PM_{2.5}$ exposure and cause-specific cardiovascular mortality in recent North American cohorts.**

CASAC ISA LETTER

- **The CASAC notes that there is a progression going from the 2009 ISA to the 2019 ISA to this Draft ISA Supplement indicating continued strengthening of the causal health endpoints relationship with $PM_{2.5}$.**
- **The literature, as it is expanding, continues to show strong associations with health effects, even though concentrations of $PM_{2.5}$ in the air have been decreasing over time.**

ISA Supplement - CASAC Letter to the EPA Administrator, page 3.

CASAC PA REVIEW

- **Draft Policy Assessment (PA)**
  - Incorporate information from the 2019 Final PM ISA and 2021 Draft Supplement ISA.
    - Focus on “causal” and “likely causal” health endpoints
- **CASAC Deliverables**
  - Letter to EPA Administrator (March 18, 2022)
    - Consensus Response to Charge Questions
    - Individual CASAC Comments

PRIMARY STANDARDS

- Section 109(b)(1) defines primary standards as ones "the attainment and maintenance of which in the judgment of the Administrator, based on such criteria and allowing an adequate margin of safety, are requisite to protect the public health."
- The CAA does not require the Administrator to establish a primary NAAQS at a zero-risk level or at background concentration levels.
- Key questions:
  - What is an "acceptable" risk?
  - How much weight should be placed on uncertainties and limitations?

EVIDENCE PRESENTED IN PA

- Epidemiologic studies
- Animal toxicological studies
- Controlled human exposure studies
- Design Value Analysis
- Risk Assessment

DESIGN VALUES vs. MEAN

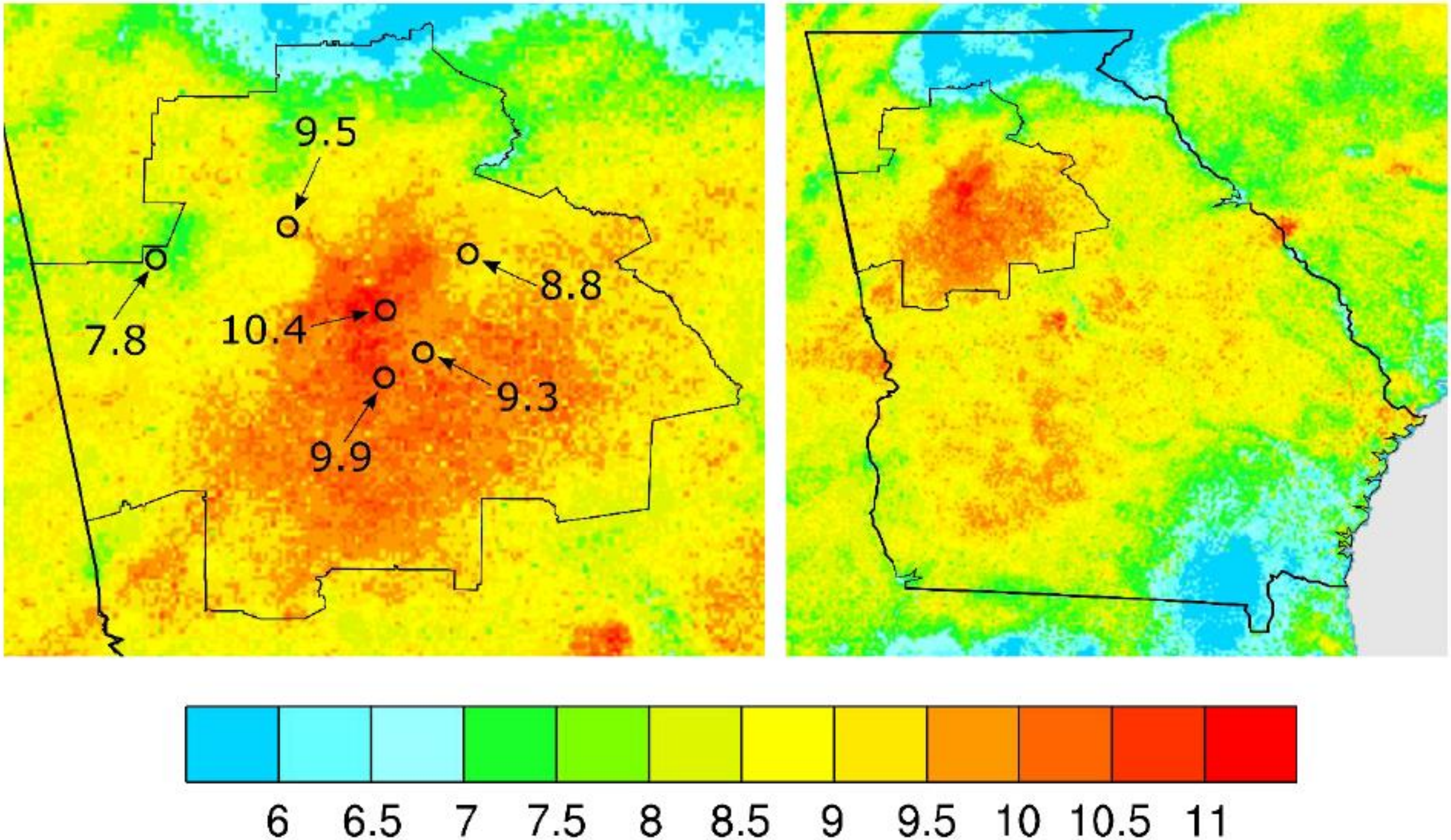


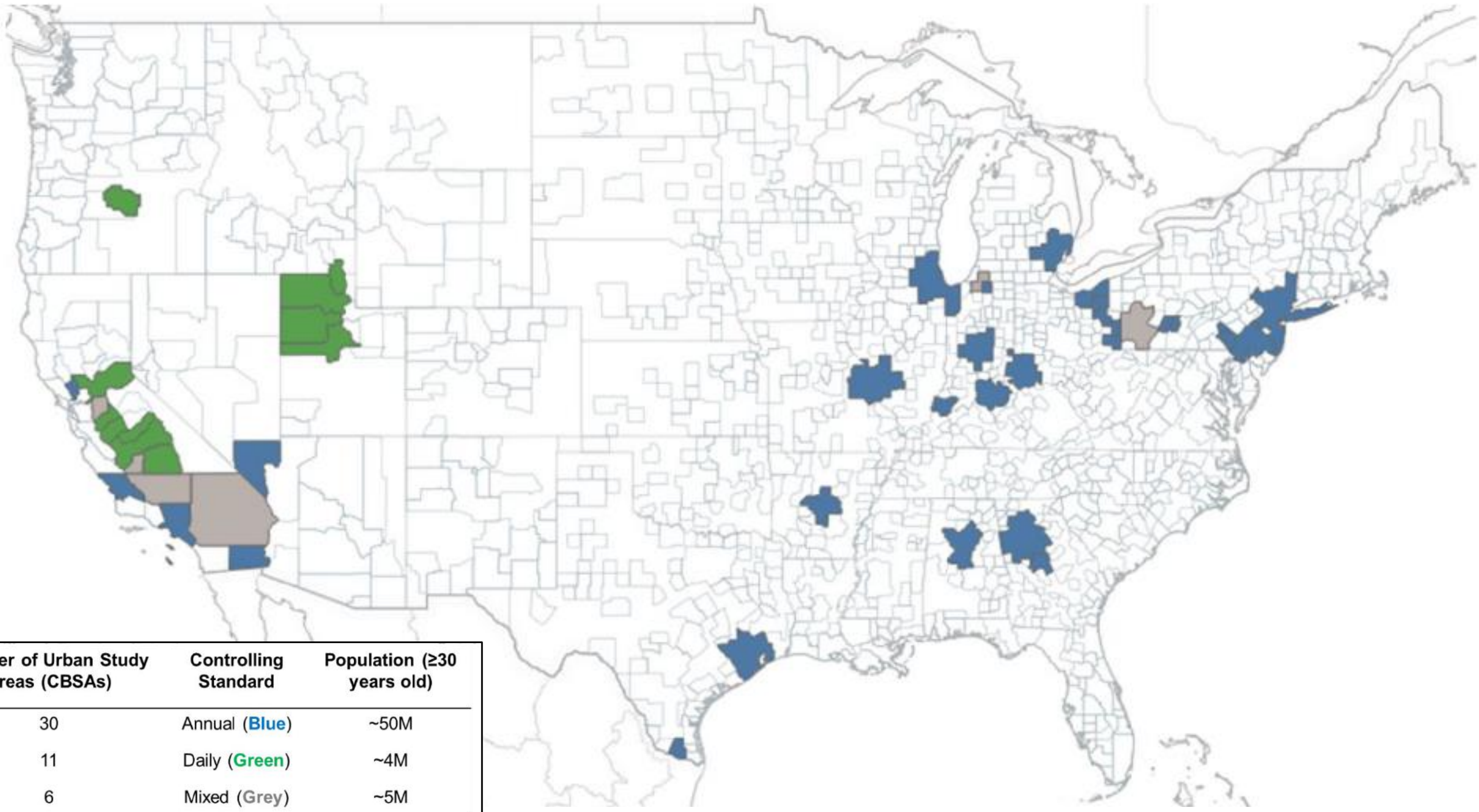
Figure 3-7. Estimated PM2.5 concentrations using the DI2019 hybrid approach and monitoring locations and design values for the state of Georgia and the Atlanta-Sandy Springs-Roswell, Georgia CBSA. (Note: Additional information on the DI2019 hybrid approach is described in section 2.3.3.1.4 and in Di et al., 2019a.)

DESIGN VALUES vs. MEAN

Description of Metric	$PM_{2.5}$ Concentrations (µg/m^3)
Atlanta highest monitor	10.4
Atlanta monitored average	9.3
Atlanta spatial average	9.2
Atlanta population-weighted average	9.6
Georgia spatial average	8.3
Georgia population-weighted average	9.1

Table 3-9. $PM_{2.5}$ Concentrations Metrics from Monitor and Modeled Data[28]

RISK ASSESSMENT MAP



Number of Urban Study Areas (CBSAs)	Controlling Standard	Population (≥30 years old)
30	Annual (**Blue**)	~50M
11	Daily (**Green**)	~4M
6	Mixed (**Grey**)	~5M
Total: 47		**~60M**

Figure 3-16. Map of 47 urban study areas included in risk modeling.

RISK ASSESSMENT APPROACH

- Concentration-response relationships are from U.S. multicity studies examining total mortality (all-cause) associated with long-term $PM_{2.5}$ exposures and total mortality (all-cause and non-accidental) associated with short-term $PM_{2.5}$ exposures
- Model-based approach to adjusting $PM_{2.5}$ air quality combined CMAQ-modeled surfaces with ambient monitoring data to generate ambient $PM_{2.5}$ estimates for 2015 on a grid with 12-km horizontal resolution
- Two strategies were used to adjust air quality to the current standards and to potential alternative standards with levels of 10.0 $\mu g/m^3$ (annual) and 30 $\mu g/m^3$ (24-hour)
- Linear interpolation and extrapolation were used to simulate just meeting additional alternative annual standard levels (8.0, 9.0 and 11.0 $\mu g/m^3$)

RISK ASSESSMENT RESULTS

Exposure	Study & Ages	Simulation Method	Total Mortality Under the Current Standard (12/35-0)	% of Baseline Mortality Attributable to the Current Standard	Total Mortality Under an Alternative Annual Standard (10-0)	Total Mortality Under an Alternative 24-Hr Standard (30-0)
Long-Term	Di (65-99)	Pri PM	40,600 (39,600 to 41,700)	7.4	35,400 (34,400 to 36,300)	40,100 (39,100 to 41,200)
		Sec PM	41,200 (40,200 to 42,300)	7.5	34,800 (33,900 to 35,700)	40,600 (39,500 to 41,600)
	Turner (30-99)	Pri PM	44,400 (30,300 to 58,200)	6.1	38,600 (26,300 to 50,700)	43,900 (30,000 to 57,500)
		Sec PM	45,100 (30,800 to 59,000)	6.2	38,000 (25,900 to 49,900)	44,400 (30,300 to 58,200)
Short-Term	Baxter (0-99)	Pri PM	2,490 (982 to 3,990)	0.4	2,160 (850 to 3,460)	2,460 (970 to 3,950)
		Sec PM	2,530 (997 to 4,050)	0.4	2,120 (837 to 3,400)	2,490 (982 to 3,990)
	Ito (0-99)	Pri PM	1,180 (-15.8 to 2,370)	0.2	1,020 (-13.7 to 2,050)	1,160 (-15.6 to 2,340)
		Sec PM	1,200 (-16.0 to 2,400)	0.2	1,000 (-13.5 to 2,020)	1,180 (-15.8 to 2,370)
	Zanobetti (65-99)	Pri PM	3,810 (2,530 to 5,080)	0.7	3,300 (2,190 to 4,400)	3,760 (2,500 to 5,020)
		Sec PM	3,870 (2,570 to 5,160)	0.7	3,250 (2,160 to 4,330)	3,810 (2,530 to 5,070)

Table 3-14. Estimates of $PM_{2.5}$-associated mortality for air quality adjusted to just meet the current or alternative standards (47 urban study areas).

RISK ASSESSMENT RESULTS

Exposure	Study & Ages	Simulation Method	Risk Change When Moving from the Current to an Alternative Annual Standard of 10	Risk Change When Moving from the Current to an Alternative 24-Hr Standard of 30	% Risk Reduction When Moving from the Current to an Alternative Annual Standard of 10	Risk Change When Moving from the Current to an Alternative 24-Hr Standard of 30
Long-Term	Di (65-99)	Pri PM	5,630 (5,490 to 5,780)	501 (488 to 514)	13.9	1.2
		Sec PM	6,820 (6,640 to 7,000)	675 (657 to 692)	16.6	1.6
	Turner (30-99)	Pri PM	6,120 (4,140 to 8,090)	555 (375 to 734)	13.8	1.2
		Sec PM	7,440 (5,040 to 9,830)	714 (483 to 943)	16.5	1.6
Short-Term	Baxter (0-99)	Pri PM	335 (132 to 537)	30.2 (11.9 to 48.4)	13.4	1.2
		Sec PM	408 (160 to 654)	38.7 (15.2 to 62.1)	16.1	1.5
	Ito (0-99)	Pri PM	158 (-2.12 to 317)	14.4 (-0.194 to 29.0)	13.4	1.2
		Sec PM	192 (-2.58 to 386)	18.4 (-0.246 to 36.9)	16.1	1.5
	Zanobetti (65-99)	Pri PM	513 (341 to 684)	45.5 (30.2 to 60.7)	13.5	1.2
		Sec PM	622 (413 to 830)	61.5 (40.8 to 82.0)	16.1	1.6

Table 3-15. Estimated reduction in $PM_{2.5}$-associated mortality for alternative annual and 24-hour standards (47 urban study areas).

RISK ASSESSMENT RESULTS

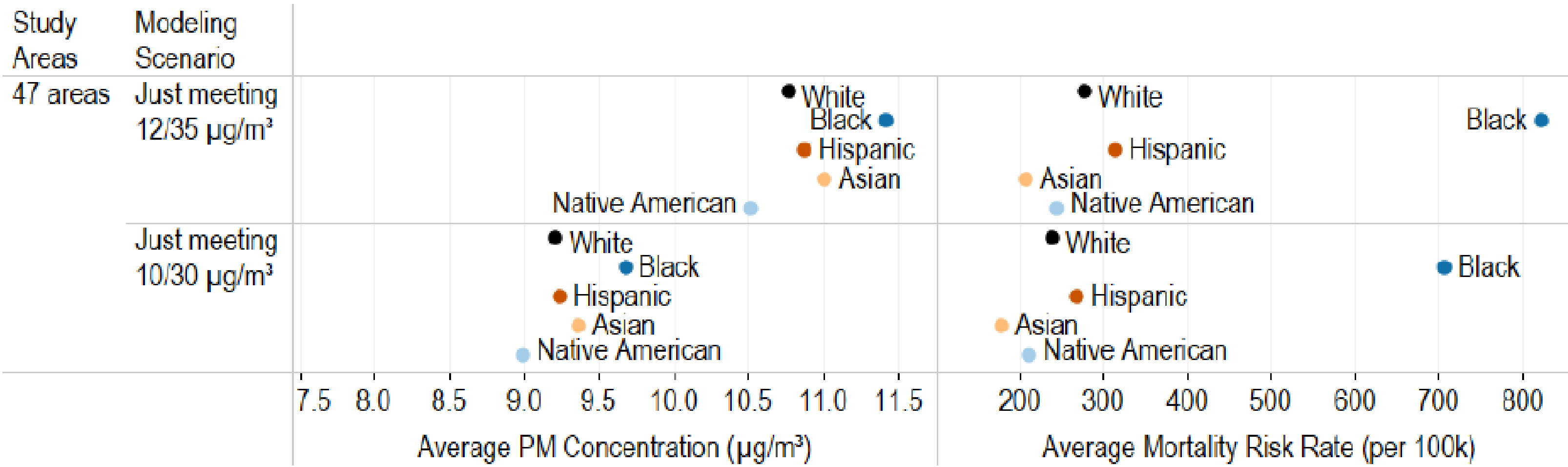


Figure 3-20. Average $PM_{2.5}$ exposure concentration and $PM_{2.5}$-attributable risk estimates by demographic population when just meeting current or alternative $PM_{2.5}$ standards.

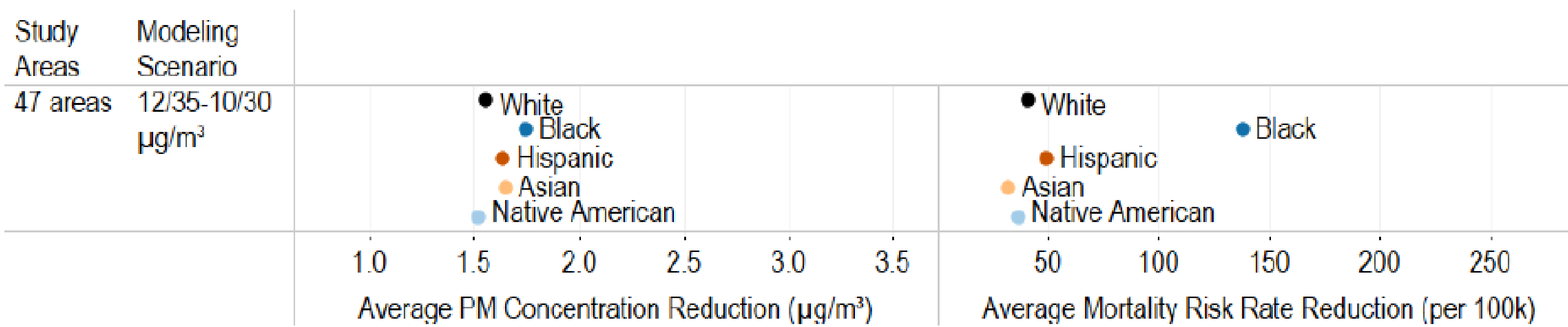


Figure 3-21. Average change in $PM_{2.5}$ exposure concentration and $PM_{2.5}$-attributable mortality risk estimates by demographic population when moving from the current to alternative $PM_{2.5}$ standards.

CASAC PA COMMENTS

- The EPA's approach evaluates the change in risk associated with moving from $PM_{2.5}$ air quality "just meeting" the current standards (12 µg/m^3/35 µg/m^3) to "just meeting" alternative annual and/or 24-hour standards (10 µg/m^3/30 µg/m^3).
- This approach estimates the number of prevented deaths from starting at the maximum ambient PM levels allowable under the current standard in each core-based statistical area (CBSA) and lowering them to alternative standards.
- It does not estimate the number of prevented deaths starting at current PM levels in the CBSAs and lowering them to alternative standards.
- To estimate the number of deaths that will be prevented if the standard was lowered from current ambient PM levels in the CBSAs, the starting point for the risk analysis for each CBSA should be the 2018-2020 $PM_{2.5}$ design values.
- The CASAC suggests presenting the results using both approaches.

Policy Assessment - CASAC Response to Charge Questions, page 10.

EXCEPTIONAL EVENTS

- The EPA should consider the implications of the exceptional events approach when applied to wildfires, particularly with respect to the risk assessment.
- According to Nagy et al. (2018), humans have ignited four times as many large fires as lightning, and humans were the dominant source of large fires in both eastern and western US.
- Their emissions have enormous impacts on nearfield exposures, regional (and continental) air quality and health over a considerable portion of the year.
- These events risk eroding the progress that has been made in air quality and health in the U.S. and it is possible that increasing wildfires and increasing exceptional events designations could substantially reduce the effectiveness of air pollution policy (David et al., 2021; Williams, 2021).

Policy Assessment - CASAC Response to Charge Questions, pages 3-4.

FRM AND FEM MONITORS

- There is an increasing trend to replace FRMs with FEMs across the country.
- FEMs can result in annual and 24-hour $PM_{2.5}$ concentrations that are meaningfully different (higher or lower) compared to FRMs, which can potentially lead to erroneous attainment designations.
- The FEM bias needs to be addressed to make the FRMs and FEMs more comparable.
- One option would be to allow states to develop correction factors for co-located FRMs and FEMs. These correction factors could be used to adjust FEM concentrations downward (or upward) to be comparable to FRMs.
- Another option would be for the EPA to revise the "equivalency box" (EB) criteria used to judge whether the bias of a new continuous $PM_{2.5}$ monitor relative to an FRM is acceptable during field testing.

Policy Assessment - CASAC Response to Charge Questions, page 2.

INDIVIDUAL COMMENTS

	24-Hour FRM COUNT	Average FRM (µg/m³)	Average FEM (µg/m³)	Avg. FEM - Avg. FRM (µg/m³)	Average Percent Difference	Max. 24-Hour FEM - FRM (µg/m³)
Athens	116	6.68	9.13	2.45	36.7%	7.31
Augusta - Bungalow	125	8.14	9.92	1.79	22.0%	9.42
Macon - Forestry	320	7.05	8.15	1.10	15.6%	15.61
Rossville	341	7.94	9.13	1.19	15.0%	7.28
Albany	557	8.91	10.83	1.92	21.6%	12.29
Gainesville	113	7.14	8.02	0.89	12.4%	3.43
Gwinnett Tech	112	8.22	10.28	2.06	25.1%	7.08
Savannah - Mercer	485	7.36	8.85	1.49	20.2%	8.34
Warner Robins	378	7.58	9.83	2.25	29.6%	11.78
S. Dekalb	977	7.95	9.14	1.19	15.0%	8.25

Table 1. Georgia EPD comparison of FRM and FEM values (green is <1 µg/m³ and <15%, yellow is 1-2 µg/m³ and 15-25%, and red is >2 µg/m³ and >25%.

Policy Assessment - Boylan Individual Comments, page A-20.

CURRENT PM NAAQS REVIEW

Determination that the current standard is adequate:

PM Standard	EPA Staff Preliminary Conclusion	CASAC Final Conclusion*	EPA Staff Final Conclusion	EPA Administrator Final Decision
Annual $PM_{2.5}$	No	No (7)**	TBD	TBD
Daily $PM_{2.5}$	Yes	No (6), Yes (1)	TBD	TBD
Daily PM_{10}	Yes	Yes (7)	TBD	TBD
Secondary $PM_{2.5}$	Yes	Yes (7)	TBD	TBD

*Numbers in parenthesis represent the number of CASAC members drawing each conclusion.

**There was not consensus on the recommended level of the annual $PM_{2.5}$ standard.

MINORITY OPINIONS

- Since the chartered CASAC and panel members are appointed, the “majority” and “minority” opinions can be determined by those selections.
- During the current deliberations, some CASAC members and panel members suggested that only the “majority” perspectives be included in the letter to the Administrator and the consensus response to charge questions and the “minority” perspectives be restricted to individual comments.
- While it is nice to try to achieve consensus, there usually is not a clear right or wrong answer and including arguments supporting both “majority” and “minority” perspectives are critical for the Administrator to make an informed decision.

Policy Assessment - Boylan Individual Comments, page A-16.

ANNUAL $PM_{2.5}$ - MAJORITY

- Regarding the level of the annual $PM_{2.5}$ standard, the majority of CASAC members find that an annual average in the range of 8-10 µg/m^3 would be appropriate.
- The range of 8-10 µg/m^3 is supported by placing more weight on: epidemiologic studies in the United States that show positive associations between $PM_{2.5}$ exposure and mortality with precision among populations with mean concentrations likely at or below 10 µg/m^3; epidemiologic studies in the United States showing such associations at concentrations below 10 µg/m^3 and below 8 µg/m^3; Canadian studies, some of which show such associations at concentrations below 10 µg/m^3 and below 8 µg/m^3; a meta-analysis of 53 studies, 14 of which report such associations at concentrations below 10 µg/m^3 down to 5 µg/m^3; protection of at-risk demographic groups; evidence consistent with no threshold and a possible supra-linear concentration-response function at lower levels; recognition that the use of the mean to define where the data provide the most evidence is conservative since robust data clearly indicate effects below the mean in concentration-response functions; and consideration that people are not randomly distributed over space such that populations in neighborhoods near design value monitors are exposed to the levels indicated at those monitors and likely to be more at risk.

Policy Assessment - CASAC Letter to the EPA Administrator, page 3.

ANNUAL $PM_{2.5}$ - MINORITY

- A minority of CASAC members find that a range of 10-11 μg/m^3 for the annual $PM_{2.5}$ standard would be appropriate.
- This range emphasizes that there are few key epidemiologic studies (and only one key U.S. study) that report positive and statistically significant health effect associations for $PM_{2.5}$ air quality distributions with overall mean concentrations below 9.6 μg/m^3 and the fact that design values are generally higher than area average exposure levels. Key U.S. epidemiologic studies indicate consistently positive and statistically significant health effect associations based on air quality distributions with overall mean $PM_{2.5}$ concentrations that range between 9.3 and 12.2 μg/m^3 for hybrid modeling with population-weighted averages. The form of the standard and the way attainment with the standard is determined (i.e., highest design value in the core-based statistical area) are important factors when determining the appropriate level for the standard. According to the Draft PA, the area annual design values are generally higher than the study means by 14-18% for hybrid modeling with population-weighted averages. Applying these percentages to the concentration ranges above result in values that are all over 10.6 μg/m^3, with most values over 11.0 μg/m^3.
- Also, the recommendation of 10-11 μg/m^3 emphasizes large uncertainties in the risk assessment, potential overestimates in the number of prevented deaths using the risk assessment approach of adjusting air quality to simulate “just meeting” the current standard, and uncertainties related to co-pollutants and confounders.

Policy Assessment - CASAC Letter to the EPA Administrator, page 3.

DAILY $PM_{2.5}$ - MAJORITY

- Regarding the level of the 24-hour $PM_{2.5}$ standard, conditional on retaining the current form, the majority of CASAC members favor lowering the 24-hour standard.
- There is substantial epidemiologic evidence from both morbidity and mortality studies that the current standard is not adequately protective. This includes three U.S. air pollution studies with analyses restricted to 24-hour concentrations below 25 $\mu g/m^3$.
- The majority of CASAC members also note that controlled human exposure studies are not the best evidence to use for justifying retaining the 24-hour standard without revision. These studies preferentially recruit less susceptible individuals and have a typical exposure duration much shorter than 24 hours. Thus, the evidence of effects from controlled human exposure studies with exposures close to the current 24-hour standard supports epidemiological evidence for lowering the standard.
- Overall, this places greater weight on the scientific evidence than on the values estimated by the risk assessment. The risk assessment may not adequately capture areas with wintertime stagnation and residential wood-burning where the annual standard is less likely to be protective. There is also less confidence that the annual standard could adequately protect against health effects of short-term exposures.
- A range of 25-30 $\mu g/m^3$ for the 24-hour $PM_{2.5}$ standard would be adequately protective.

Policy Assessment - CASAC Letter to the EPA Administrator, pages 3-4.

DAILY $PM_{2.5}$ - MINORITY

- In contrast, a minority of CASAC members concur with the EPA's preliminary conclusion to retain the current 24-hour standard without revision.
- This view places greater weight on the risk assessment. The risk assessment not only accounts for the level of the standard, but also accounts for the form of the standard and the way attainment with the standard is determined (i.e., highest design value in the core-based statistical area). The risk assessment indicates that the annual standard is the controlling standard across most of the urban study areas evaluated and revising the level of the 24-hour standard is estimated to have minimal impact on the $PM_{2.5}$-associated risks. Therefore, the annual standard can be used to limit both long- and short-term $PM_{2.5}$ concentrations.
- This view places more emphasis on the controlled human exposure studies, showing effects at $PM_{2.5}$ concentrations well above those typically measured in areas meeting the current standards suggesting to them that the current standards are providing adequate protection against these exposures.

Policy Assessment - CASAC Letter to the EPA Administrator, page 4.

VISIBILITY

- **Greater justification needs to be provided for a secondary standard for PM based on a visibility index of 30 deciviews (~12 miles visual range) and a 3-year average of 90th percentile of daily light extinction for visibility analysis.**

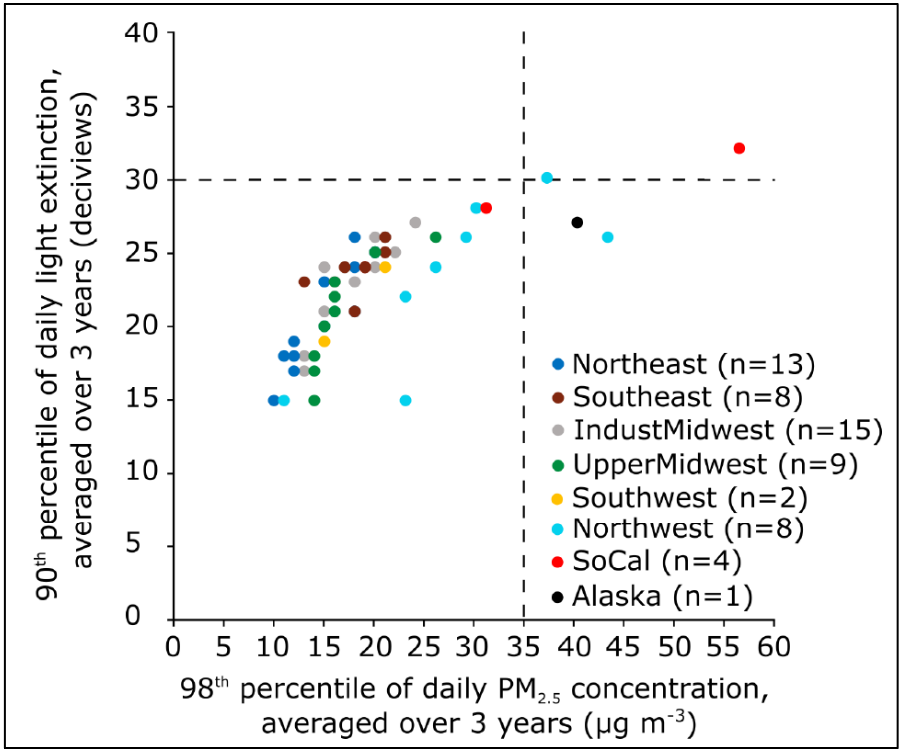


Figure 5-4. Comparison of 90th percentile of daily light extinction, averaged over three years, and 98th percentile of daily $PM_{2.5}$ concentrations, averaged over three years, for 2015-2017 using the Lowenthal and Kumar equation.

Policy Assessment - CASAC Letter to the EPA Administrator, page 4.

VISIBILITY FRM

- Consistent with previous reviews (U.S. EPA, 2010b), the majority of CASAC members recommend that a FRM for a directly measured $PM_{2.5}$ light extinction indicator be developed as a requisite to provide the basis for a secondary standard protective of visibility.
- However, a minority of CASAC members believe that a light extinction FRM is not necessary to set a secondary standard protective of visibility or to show attainment with that standard.

Policy Assessment - CASAC Response to Charge Questions, page 22.

UPCOMING CASAC OZONE NAAQS REVIEW

CURRENT CASAC OZONE PANEL

1. Dr. Elizabeth A. (Lianne) Sheppard (Chair) - University of Washington
2. Mr. George Allen - Northeast States for Coordinated Air Use Management
3. Mr. Ed Avol - University of Southern California
4. Dr. James Boylan - Georgia Department of Natural Resources
5. Dr. Judith Chow - Desert Research Institute
6. Dr. Mark Frampton - University of Rochester Medical Center
7. Dr. Christina Fuller - Georgia State University School of Public Health
8. Dr. Terry Gordon - New York University School of Medicine
9. Dr. Daniel Jacob - Harvard University
10. Dr. Catherine Karr - University of Washington
11. Dr. Michael Kleinman - University of California, Irvine
12. Dr. Danica Lombardozzi - National Center for Atmospheric Research
13. Dr. Howard Neufeld - Appalachian State University
14. Dr. Jennifer Peel - Colorado State University
15. Dr. Richard Peltier - University of Massachusetts Amherst
16. Dr. Alexandra Ponette-González - University of North Texas
17. Dr. Jeremy Sarnat - Emory University
18. Dr. Jason West - University of North Carolina at Chapel Hill

CASAC MEETINGS

- Kick-off meeting
  - Friday, April 29, 2022, 11:00 AM – 3:00 PM ET

- Policy Assessment Peer Review Meetings
  - Wed, June 8, 2022, 11:00 AM – 3:00 PM ET
  - Fri, June 10, 2022, 11:00 AM – 3:00 PM ET
  - Mon, June 13, 2022, 11:00 AM – 3:00 PM ET
  - Fri, June 17, 2022, 11:00 AM – 3:00 PM ET

CONTACT INFORMATION

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