

National Ambient Air Quality Standards for Particulate Matter and Ozone



Meeting of the Agricultural Air Quality Task Force
September 29, 2010

Lydia Wegman

Director Health and Environmental Impacts Division

Ongoing NAAQS Reviews: Current Schedule

revised 7-23-2010

MILESTONE	POLLUTANT						
	NO ₂ Primary	SO ₂ Primary	Ozone Reconsideration	CO	PM	NO ₂ /SO ₂ Secondary	Lead
NPR	<u>Jun 26, 2009</u>	<u>Nov 16, 2009</u>	Jan 6, 2010	<u>Jan 28, 2011</u>	Feb 2011	<u>July 12, 2011</u>	Nov 2013
NFR	<u>Jan 22, 2010</u>	<u>Jun 2, 2010</u>	End of October 2010	<u>Aug 12, 2011</u>	Oct 2011	<u>Mar 20, 2012</u>	Sept 2014

NOTE:

Underlined dates indicate court-ordered or settlement agreement deadlines.

PM NAAQS Review: Schedule

- Integrated Science Assessment
 - Finalized December 2009
- Risk and Exposure Assessments
 - Quantitative Health Risk Assessment finalized June 2010
 - Urban-Focused Visibility Assessment finalized July 2010
- Policy Assessment
 - Second draft released for CASAC and public review in June 2010
 - Final document targeted for October 2010
- Proposed rulemaking – February 2011
- Final rulemaking – October 2011
- For more information:

http://www.epa.gov/ttn/naaqs/standards/pm/s_pm_index.html

Review of Primary PM Standards

- Staff and Clean Air Scientific Advisory Committee (CASAC) conclusions
 - Draft staff conclusions presented in second draft Policy Assessment
 - CASAC comments on second draft Policy Assessment provided in September 10 letter to EPA Administrator (Samet, 2010)
- PM_{2.5} primary standards
 - Need to address remand of 2006 decision to retain annual PM_{2.5} standard
 - Need to take into account extensive new health evidence, including epidemiological studies of long- and short-term exposures, in considering whether to retain or revise current standards
- PM₁₀ primary standard
 - Purpose of the current 24-hour PM₁₀ standard is to protect against exposures to thoracic coarse particles (PM_{10-2.5})
 - In drawing conclusions about the level of health protection provided by the current PM₁₀ standard, we need to take into account an expanded body of thoracic coarse particle health evidence as well as the uncertainties associated with that evidence

PM_{2.5} Primary Standards: Staff and CASAC Conclusions

Adequacy of current standards

- CASAC concurs with staff conclusion that the currently available evidence clearly calls into question adequacy of protection afforded by current suite of PM_{2.5} standards

Potential alternative standards

- **Indicator and Averaging time:** Staff concludes that it is appropriate to consider retaining PM_{2.5} mass-based indicator and annual and 24-hour averaging times
 - CASAC concurs with these staff conclusions and urges EPA to “reinvigorate” research on chemical components, sources, and ultrafine particles to inform future reviews
- **Levels:** Draft Policy Assessment identifies a range of potential alternative standard levels, consistent with a generally controlling annual standard and a 24-hour standard that would provide supplemental protection
 - Annual standard: Consider revising level within a range of 13-11 µg/m³
 - 24-hour standard: Consider retaining level at 35 µg/m³, in conjunction with revising the level of the annual standard; alternatively, consider revising level to 30 µg/m³
 - CASAC concludes, “the levels under consideration are supported by the epidemiological evidence, as well as by the risk and air quality information”
- **Form:** CASAC concurs with staff conclusion that consideration be given to revising form of annual standard to eliminate spatial averaging provisions

PM₁₀ Standard: Health Evidence in Current Review

- Our characterization of the health evidence in the current review is based on ORD's PM Integrated Science Assessment (ISA)
 - PM ISA has undergone multiple rounds of CASAC review and discussion at public meetings and CASAC has endorsed its conclusions
- Compared to the last review, the ISA has assessed an expanded body of PM_{10-2.5} epidemiologic studies as well as a small number of recent PM_{10-2.5} controlled human exposure studies and animal toxicological studies
 - Approximately 50 epidemiologic studies published since the last review, mostly single-city studies, though several recent multi-city studies have also been published
 - Most studies were conducted in locations where thoracic coarse particles are largely of urban origin, though a few recent studies do provide support for associations with relatively high concentrations of PM of non-urban origin (i.e., from dust storms)

PM₁₀ Standard: Health Evidence (cont.)

- Positive associations with PM_{10-2.5} have been reported in almost 50 urban locations (in single- and multi-city studies) that would likely have met the current PM₁₀ standard during the study period
 - In the few studies that also considered co-pollutants, associations with PM_{10-2.5} remained positive
 - A small number of controlled human exposure studies provide support for the plausibility of associations in epidemiologic studies
- A few recent dust storm studies have reported associations between mortality or morbidity and PM of non-urban, crustal origin
 - Associations were generally positive, with some being statistically significant
 - PM₁₀ concentrations were likely well above those allowed by the PM₁₀ standard
 - Mostly non-U.S. studies (e.g., Asia, Europe)

PM₁₀: Adequacy of the Current Standard

- **Staff conclusion** in draft Policy Assessment: **appropriate to consider either retaining or revising** the current standard, depending on the weight placed on the available evidence and the uncertainties and limitations in that evidence
 - Staff conclusion reflects the purpose of the Policy Assessment, which is to identify the broadest range of policy options that could be supported by the evidence
- Consideration of **revising** the current standard would place a large amount of weight on...
 - Positive associations for mortality and morbidity effect in locations that would likely have met the current standard
 - Supporting evidence that these associations are appropriately attributed to PM_{10-2.5}
- Consideration of **retaining** the current standard would necessarily place a large amount of weight on the uncertainties and limitations in the evidence, including...
 - Uncertainty in the extent to which reported health effects are due to PM_{10-2.5} across different types of environments (e.g., including urban and non-urban)
 - Limitations in the current monitoring network, and the importance of considering new PM_{10-2.5} monitoring data that will be available to inform the next review

PM₁₀: Adequacy of Current Standard (cont.)

- **CASAC conclusion:** CASAC concluded that the available evidence, while limited, is sufficient to **call into question the level of protection provided by the current standard**
 - CASAC recommended that consideration be given to **revising** the **current 24-hour PM₁₀ standard** in order to **increase public health protection**
 - CASAC did not support the option of retaining the current standard
- In reaching these conclusions, CASAC gave weight to the following:
 - Positive associations in epidemiologic studies, including studies conducted in locations with PM₁₀ air quality concentrations allowed by the current standard
 - Epidemiologic studies that have reported PM_{10-2.5} effect estimates that remain positive in co-pollutant models
 - Controlled human exposure studies that support the plausibility of epidemiological associations

PM₁₀: Potential Alternative Standards

- **Indicator:** CASAC agrees with staff conclusion that the available evidence supports retaining the current PM₁₀ indicator
 - A PM₁₀ standard would be expected to allow lower PM_{10-2.5} concentrations in locations where the evidence provides the strongest support for effects of PM_{10-2.5} (i.e., urban locations)
 - Consideration of alternative indicators (e.g., PM_{10-2.5}) in future reviews is desirable and could be informed by additional research
- **Averaging Time:** CASAC agrees with staff conclusion that available evidence supports consideration of retaining a 24-hour standard and not setting a long-term standard
 - Most evidence comes from epidemiologic studies that examined associations between health effects and 24-hour average PM_{10-2.5} concentrations
 - Very little evidence for associations with long-term PM_{10-2.5} concentrations (ISA judged that evidence is “inadequate” to infer a causal relationship)

PM₁₀: Potential Alternative Standards (cont.)

- **Form:** CASAC agrees with staff conclusion that it is appropriate to consider revising the form to the 98th percentile of the annual distribution of 24-hour PM₁₀ concentrations, averaged over 3 years
 - Compared to current 1-expected-exceedance form, a 98th percentile form better reflects the health risks posed by elevated pollutant concentrations
 - For other NAAQS (i.e., PM_{2.5}, NO₂, SO₂) we have switched to this type of form
 - A 98th percentile form would better compensate for missing data and less-than-daily monitoring
- With either form, determining attainment depends on the frequency of PM₁₀ monitoring...
 - Current form compares a very extreme air quality statistic to the standard level
 - Either the highest, 2nd highest, or 4th highest PM₁₀ concentration in 3 years for 1-in-6-day, 1-in-3-day, or every day monitoring, respectively
 - A 98th percentile form, averaged over 3 years, would compare a less extreme air quality statistic that is less variable year-to-year; would result in more consistency of protection in areas across the country

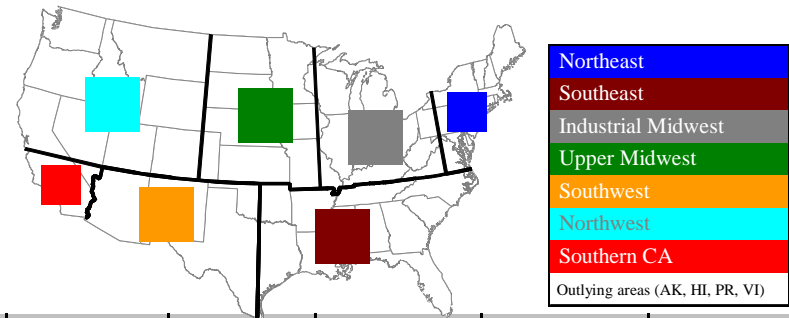
PM₁₀: Potential Alternative Standards (cont.)

- **Level:** Range of levels supported in the draft Policy Assessment was based primarily on consideration of the 98th percentile PM₁₀ concentrations in U.S. study locations
 - Also considered what level (with a 98th percentile form) would be “generally equivalent” nationally to the current standard
- Based on PM₁₀ concentrations in epidemiological studies showing associations with PM_{10-2.5}, ...
 - Single-city studies provide strongest support for a level somewhat below 90 µg/m³
 - Multi-city studies provide further support for a level within the range of approximately 65 to 75 µg/m³
- “Generally equivalent” 98th percentile concentration...
 - Up to 87 µg/m³, based on comparing air quality data at individual monitors across the U.S.
 - Between 75 and 80 µg/m³, based on number of people living in counties likely not meeting the current and alternative standards
- Based on the above, staff concluded that consideration could be given to PM₁₀ standard levels from **85 µg/m³ down to 65 µg/m³** (in conjunction with a 98th percentile form) with the upper part of the range supported by the strongest evidence

PM₁₀: Potential Alternative Standards (cont.)

- CASAC agreed that it is appropriate to consider standard levels from 85 to 65 $\mu\text{g}/\text{m}^3$; however, they **recommended** setting the level in the range of **75 to 65 $\mu\text{g}/\text{m}^3$**
- In making this recommendation, based on the available evidence and associated uncertainties, CASAC concluded that the evidence is sufficient to call into question the level of protection provided by the current standard
 - CASAC thus recommended that consideration be given to revising the current 24-hour PM₁₀ standard in order to increase public health protection
 - In so doing, CASAC noted that a 98th percentile PM₁₀ standard with a level between 75 and 80 $\mu\text{g}/\text{m}^3$ could provide a level of public health protection that is generally equivalent nationally to that provided by the current standard
- Given these considerations, CASAC concluded that a 98th percentile PM₁₀ standard with a level at or below 75 $\mu\text{g}/\text{m}^3$, and potentially as low as 65 $\mu\text{g}/\text{m}^3$, could appropriately increase public health protection against exposures to thoracic coarse particles

Estimates of Counties/Population Not Likely to Meet Current and Potential Alternative PM₁₀ Standards



Region >		All U.S.	Northeast	Southeast	Industrial Midwest	Upper Midwest	Southwest	Northwest	Southern California
Total # of counties >		307	37	57	50	40	25	77	18
Total population >		120,090	15,397	27,181	21,352	5,917	11,112	15,270	22,695
Current Standard	# counties	42	0	3	0	2	11	14	11
	Population (thousands)	30,044	0	4,626	0	43	5,485	1,906	17,724
3-year average 98 th percentile > 87 µg/m ³	# counties	37	0	2	2	2	11	10	9
	population	20,515	0	4,063	507	552	5,924	1,789	7,421
3-year average 98 th percentile > 85 µg/m ³	# counties	39	0	2	3	2	12	10	9
	population	21,887	0	4,063	1,789	552	6,014	1,789	7,421
3-year average 98 th percentile > 80 µg/m ³	# counties	39	0	2	3	2	12	10	9
	population	21,887	0	4,063	1,789	552	6,014	1,789	7,421
3-year average 98 th percentile > 75 µg/m ³	# counties	55	0	3	6	5	13	15	12
	population	35,703	0	4,626	3,491	637	6,131	2,570	17,986
3-year average 98 th percentile > 70 µg/m ³	# counties	71	0	4	7	7	13	27	12
	population	43,823	0	4,644	8,868	881	6,131	5,052	17,986
3-year average 98 th percentile > 65 µg/m ³	# counties	87	2	4	9	10	14	33	143
	population	49,394	775	4,644	10,421	1,029	7,507	5,989	18,739

Reconsideration of 2008 Secondary Ozone NAAQS



Overview of 2010 proposal

- On January 6, 2010, EPA proposed to set different National Ambient Air Quality Standards (NAAQS) for ground-level ozone than were set in 2008
- The proposed standards are based on scientific evidence about ozone and its effects on people and sensitive trees and plants
- The proposal addressed both the primary (health-based) and secondary (welfare-based) ozone standards:
 - **Primary standard** to protect public health, including the health of at-risk populations such as children, people with asthma, and older adults
 - **Secondary standard** to protect public welfare and the environment, including sensitive vegetation and ecosystems
- EPA proposed:
 - To set the level of the primary 8-hour ozone standard to a level within the range of 0.060-0.070 parts per million (ppm)
 - Proposed to establish a new cumulative, seasonal secondary standard within a range of 7-15 ppm-hours
- EPA plans to issue final standards around the end of October

Summary of secondary standard proposal

- Proposed to set a cumulative, seasonal secondary standard to provide increased protection for sensitive vegetation and forested ecosystems, *not for agricultural crops*
 - Proposed a specific concentration-weighted index, the *W126* index
 - Summed over *12 hours per day* during the maximum *3-month period* within the O₃ growing season
 - Calculated as the *3-year average* of the annual sums to provide increased stability in light of large year-to-year variability
 - Level within range of *7-15 ppm-hours*
- Generally consistent with CASAC advice (before and after 2008 decision), although CASAC recommendation on level based on an *annual*, not *3-year average*, standard
- Similar to cumulative, seasonal secondary standards proposed in 1996 and 2007, which also had been supported by CASAC

Summary of secondary standard proposal (cont.)

- Proposal concluded that:
 - *Highest priority and significance* should be given to effects known or likely to occur in *Federally protected areas such as Class I areas* (national parks and forests, wilderness areas, and memorial parks) and *lands set aside by States, Tribes and public interest groups* to provide similar benefits to the public welfare, for residents on those lands, as well as visitors to those areas
 - A standard set so as to protect sensitive natural vegetation and ecosystems would likely also provide protection for other vegetation, including *ornamentals used in urban/suburban landscaping*
 - *There is no need for additional protection for agricultural crop lands* through the NAAQS, since agricultural systems are heavily managed and adverse impacts from other factors (e.g., weather, insects, disease) can be orders of magnitude greater than from O₃ exposure alone
 - Current O₃ concentrations in many areas **are sufficient to cause vegetation effects judged to be adverse**, including visible foliar injury and impaired growth in sensitive species, **even in areas that would meet the 2008 8-hour standard**

Nature and adversity of response in sensitive vegetation

- Plant response to O_3 depends on both *cumulative exposures over the growing season* and *levels of exposure*
- *Effects of O_3 on sensitive tree species* include impairment of growth, visible foliar injury, loss of vigor and competitive advantage, increased susceptibility to disease, insects, and harsh weather
- Injury at the species level that is of sufficient magnitude as to impair or reduce the intended use or value of the plant (also called “**damage**”) is considered **adverse to the public welfare**
 - Federal land managers (e.g., National Park Service and U.S. Forest Service managers) consider O_3 -related visible foliar injury and leaf senescence to be adverse if they have a negative impact on aesthetic value
- Ozone-related damage at the species level can also have *adverse implications for ecosystems*
 - Altered ecosystem structure and function, including changes in biodiversity and impacts on water availability in watersheds
 - Reduced ecosystem services and carbon sequestration

Important ozone-sensitive tree species

- **Sensitivity to O_3** is highly variable across tree species, with known O_3 -sensitive tree species occurring in state and national parks and forests, including:
 - Western forests (San Bernardino Mtns.; Sequoia, Kings Canyon, and Yosemite National Parks):
 - ***Ponderosa pine*** -- one of most widely distributed pines in western U.S.; major source of timber, important for wildlife habitat and aesthetic value
 - Eastern and/or Midwestern forests (Shenandoah and Great Smoky Mtn. National Parks; Adirondak and Green Mtns; National parks and forests in Great Lakes region):
 - ***Black Cherry*** - valuable for furniture making, fast growing, important ecologically and commercially
 - ***Quaking Aspen*** – pulpwood, fast growing, important ecologically and commercially
 - ***Cottonwood*** - fast growing, important ecologically along rivers and streams, and commercially
 - ***Red Maple*** -- abundant, important for brilliant fall foliage and highly desirable food for wildlife
 - ***Yellow Poplar*** -- abundant in southern Appalachian forests; valued commercially for furniture and construction; important wildlife food and shade tree
 - ***White Pine*** – abundant in the northeastern U.S. and along the Appalachian mountains; important for wildlife habitat and urban ornamentals
 - ***White Ash*** – important baseball bats, flooring

Overview of Comments

- Department of Interior/National Park Service: Strongly supported proposal, especially in the lower part of the proposed range of levels
 - Offered assistance to EPA to identify protected areas of national interest and O₃-sensitive resources in those areas
- States, regional, and Tribal governments: mixed comments
 - Those not supporting proposal mostly expressed implementation-related concerns
- Other stakeholders: sharply divergent views, ranging from:
 - Support for lower part of proposed range of levels
 - General support for the proposed range
 - Opposition to setting secondary standard different from the primary standard