



The National Ambient Air Quality Standards (NAAQS) for Particulate Matter (PM): EPA's 2006 Revisions and Associated Issues

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Summary

Following its review of more than 2,000 scientific studies, on October 17, 2006, the Environmental Protection Agency (EPA) published its final revisions to the National Ambient Air Quality Standards (NAAQS) for particulate matter (particulates, or PM). Several states and industry, agriculture, business, and environmental and public health advocacy groups petitioned the court, challenging certain aspects of EPA's revisions. A February 24, 2009, decision by the U.S. Court of Appeals for the District of Columbia Circuit granted the petitions in part, denying other challenges, and remanded the standards to EPA for further consideration. While the court did not specifically vacate the 2006 PM standards, EPA has announced its intention to accelerate its ongoing next round of the periodic review of the particulates NAAQS, in part, in response to the court's decision. These actions, and EPA's ongoing implementation of the 2006 PM NAAQS, have prompted renewed interest among Members of Congress.

Experiences and issues leading up to and following the promulgation of the 2006 PM_{2.5} NAAQS could provide relevant insights as EPA proceeds with its current review of the particulates NAAQS. Although a tightening of the standards, the 2006 particulates NAAQS are not as stringent as recommended by EPA staff or the independent scientific advisory committee mandated under the Clean Air Act (Clean Air Scientific Advisory Committee, or CASAC). The divergence from the CASAC's recommendations proved controversial, as did several other elements of the 2006 particulates NAAQS, including the decision not to exclude rural sources from the coarse particle standard. Some have also questioned the EPA's strengthening of the standard for *all* fine particles, without distinguishing their source or chemical composition.

The EPA found that the evidence continued to support associations between exposure to particulates in ambient air and numerous significant health problems. Based on several analytical approaches, the EPA estimated that compliance with the revised NAAQS will prevent 1,200 to 13,000 premature deaths annually, as well as substantial numbers of hospital admissions and missed work or school days due to illness. Based on these findings, EPA revised the PM NAAQS by strengthening the preexisting (1997) standard for "fine" particulate matter 2.5 micrometers or less in diameter (PM_{2.5}) by lowering the allowable *daily* concentration averaged over 24-hour periods of PM_{2.5} in the air. The *annual* PM_{2.5} standard, which is set in addition to the daily standard to address human health effects from chronic exposures to the pollutants, is unchanged from the 1997 standard. The decision not to tighten the annual standard was reversed by the D.C. Circuit and remanded to EPA for consideration.

The 2006 particulates NAAQS also retained the 24-hour standard and revoked the annual standard for slightly larger, but still inhalable, particles less than or equal to 10 micrometers (PM₁₀). The EPA abandoned its proposal to replace the particle size indicator of PM₁₀ with a range of 10 to 2.5 micrometers (PM_{10-2.5}). The D.C. Circuit's February 24, 2009, decision upheld EPA's decisions with regard to PM₁₀ NAAQS.

EPA's ongoing implementation of the 2006 NAAQS, including EPA's November 13, 2009, final designation of those geographical areas not in compliance (typically defined by counties or portions of counties), has been an area of debate among some Members of Congress, states, and other stakeholders. Although EPA is not requiring new nonattainment designations for PM₁₀, the tightening of the PM_{2.5} standard increased the number of areas in nonattainment. EPA's final designations for the 2006 PM NAAQS include 120 counties and portions of counties in 18 states as nonattainment areas based on 2006 through 2008 air quality monitoring data.

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Introduction

The EPA has identified and promulgated National Ambient Air Quality Standards (NAAQS) under the Clean Air Act (CAA)¹ for six principal pollutants commonly referred to as “criteria pollutants”: particulate matter (PM), ozone (O₃, a key measure of smog), nitrogen dioxide (NO₂, or, inclusively, nitrogen oxides,² NO_x), sulfur oxides (SO_x, or, specifically, SO₂), carbon monoxide (CO), and lead (Pb). On October 17, 2006, the EPA published its revisions to the NAAQS for particulates to provide protection against potential health effects associated with short- and long-term exposure to particulate matter (including chronic respiratory disease and premature mortality).³

The EPA’s revised particulates NAAQS modified the standards established in 1987⁴ that focused on particles smaller than 10 micrometers (PM₁₀, or coarse particles), and standards for “fine” particles smaller than 2.5 micrometers⁵ (PM_{2.5}) introduced for the first time with the promulgation of the 1997 PM_{2.5} NAAQS.⁶ The 2006 revisions to the particulates NAAQS were the culmination of the EPA’s statutorily required periodic review,⁷ based on its evaluation and analysis of more than 2,000 scientific studies available between 1997 and 2002, and on determinations made by the Administrator. The EPA’s review of the particulates NAAQS and of the scientific criteria for setting the standards completed in 2006 was initiated not long after the 1997 promulgation.

The 2006 particulates NAAQS generated national interest and debate, and oversight in Congress, as did the previous changes to the particulates standards promulgated in 1997. While the 2006 particulates NAAQS generally tightened the air quality standards for fine particulate matter, the action caused considerable controversy, including concerns that the standards were outside the range recommended by both EPA staff and by the scientific advisory panel (Clean Air Scientific Advisory Committee, or CASAC⁸) established by the CAA.⁹ Conversely, some contended that available data did not support the need for stricter standards or, in some cases, the standards as promulgated in 1997.

A February 24, 2009, decision by the U.S. Court of Appeals for the D.C. Circuit¹⁰ to grant, in part, petitions challenging certain aspects of the EPA’s revised NAAQS generated renewed interest in the PM NAAQS. In December 2006, 13 states, the District of Columbia, and several state agencies had petitioned the U.S. Court of Appeals for the D.C. Circuit to review the 2006

¹ Sections 108-109 of the Clean Air Act.

² The NAAQS is for NO₂; nitrogen gases that are ozone precursors are referred to as NO_x.

³ 71 *Federal Register* 61143-61233, October 17, 2006. See also EPA’s PM Regulatory Actions website at <http://epa.gov/pm/actions.html>.

⁴ 52 *Federal Register* 24634-24715, July 1, 1987.

⁵ A micrometer is 1/1000th of a millimeter; there are 25,400 micrometers in an inch.

⁶ 62 *Federal Register* 38652-38896, July 18, 1997. See CRS Report RL32431, *Particulate Matter (PM_{2.5}): Implementation of the 1997 National Ambient Air Quality Standards (NAAQS)*, by Robert Esworthy.

⁷ Section 109(d)(1) of the CAA. According to the statute, the EPA is required to review the latest scientific studies and either reaffirm or modify the NAAQS every five years, however EPA has rarely met this requirement and in some cases has been forced to comply through litigation.

⁸ For information regarding the CASAC PM review panel and its activities and reports, see <http://yosemite.epa.gov/sab/sabpeople.nsf/WebCommittees/CASAC>.

⁹ Section 109(d)(2) of the Clean Air Act.

¹⁰ *American Farm Bureau Federation v. U.S. EPA*, No. 06-1410 (D.C. Cir., February 24, 2009).

particulates NAAQS.¹¹ In addition, several groups representing various industry and agriculture interests (including coal, iron, steel, and corn refiners, oilseed processors, farmers, and cattle and pork producers), as well as environmental and public health organizations, filed petitions with the D.C. Circuit challenging the 2006 NAAQS.¹² Petitioners, joined by several interveners and amici, challenged both the fine and coarse particulates standards.

The court's decision did not vacate the PM standards but remanded certain aspects of the annual PM_{2.5} standard to EPA for reconsideration; the petitions did not challenge the tightening of the daily (24-hour) standard. Although implementation of the 2006 PM NAAQS continues,¹³ EPA's eventual actions in response to the court's decision could have implications in the near future.

EPA's next round of the periodic review of the particulates NAAQS (including both PM_{2.5} and PM₁₀) is under way. The agency announced its intention to accelerate the review, in part in response to the D.C. Circuit Court's decision. EPA has targeted proposing any changes to the standards by February 2011 and October 2011 for final standards.¹⁴ Potential risk reduction estimates and initial staff recommendations reported in recently released draft EPA assessments¹⁵ suggest further strengthening of the particulates NAAQS. In their initial reviews of EPA's draft assessments, members of the CASAC agreed that the evidence calls into question the adequacy of protection afforded by the current standards.¹⁶ EPA's draft assessments and the issue of whether the particulates NAAQS should be strengthened or not have generated considerable comment and debate.

The range of issues raised prior to and following the promulgation of the 2006 PM_{2.5} NAAQS could provide relevant insights as EPA proceeds with its current review of the particulates NAAQS. This CRS report provides an analysis of the agency's final 2006 revisions to the particulates NAAQS, and the estimated costs and benefits of the revised standards and of more stringent alternatives analyzed. The report also highlights concerns and issues raised regarding

¹¹ Three amici states filed jointly with the 13 party states.

¹² Cases were consolidated with *American Farm Bureau Federation v. U.S. EPA*, 2009 Westlaw 437050, No. 06-1410 (D.C. Cir. 2006).

¹³ For a more detailed discussion of the NAAQS implementation process for designating geographical nonattainment areas with respect to the tightening of the PM_{2.5} standards under the 2006 particulates NAAQS, including comparisons with the final designations under the 1997 PM_{2.5} NAAQS, see CRS Report R40096, *2006 National Ambient Air Quality Standards (NAAQS) for Fine Particulate Matter (PM_{2.5}): Designating Nonattainment Areas*, by Robert Esworthy.

¹⁴ Page 45220 of EPA Proposed Rule: Federal Implementation Plans to Reduce Interstate Transport of Fine Particulate Matter and Ozone, or "Proposed Transport Rule," as published in *75 Federal Register* 45210–45465, August 2, 2010.

¹⁵ See *Policy Assessment for the Review of the PM NAAQS - First External Review Draft* (EPA 452/P-10-003, March 2010) and *Policy Assessment for the Review of the PM NAAQS - Second External Review Draft* (EPA-452/P-10-007, June 2010) available at http://www.epa.gov/ttn/naaqs/standards/pm/s_pm_2007_pa.html. U.S. EPA, *Integrated Science Assessment for Particulate Matter (Final Report)* (EPA/600/R-08/139F, December 2009), and *Risk Assessment to Support the Review of the PM Primary National Ambient Air Quality Standards—External Review Draft* (EPA 450/P-09-006, September 2009); *74 Federal Register* 46589-46591, September 10, 2009. Both assessments are available at http://www.epa.gov/ttn/naaqs/standards/pm/s_pm_2007_fr.html.

¹⁶ EPA Clean Air Advisory Committee (CASAC) Particulate Matter (PM) Review Committee: *CASAC Review of Policy Assessment for the Review of the PM NAAQS – Second External Review Draft (June 2010)*, August 10, 2010 Draft, [http://yosemite.epa.gov/sab/sabproduct.nsf/WebCASAC/AD891A65C35DC3738525777B005B0A6F/\\$File/PM+PA-2+letter+8-10-10.pdf](http://yosemite.epa.gov/sab/sabproduct.nsf/WebCASAC/AD891A65C35DC3738525777B005B0A6F/$File/PM+PA-2+letter+8-10-10.pdf); *CASAC Review of Policy Assessment for the Review of the PM NAAQS - First External Review Draft (March 2010)*, May 17, 2010, E504EE3276D87A9E8525772700647AFB/\$File/EPA-CASAC-10-011-unsigned.pdf. See also CASAC's *Review of Quantitative Health Risk Assessment for Particulate Matter—Second External Review Draft, (February 2010)*, April 15, 2010. <http://yosemite.epa.gov/sab/sabproduct.nsf/WebCASAC/recentadditions>.

the 2006 revisions to the particulates standards, including those of the science advisory committee (CASAC), and actions in Congress.

EPA's 2006 Changes to the Particulates NAAQS

Establishing NAAQS does not directly limit emissions; rather, it represents the EPA Administrator's formal judgment regarding the level of ambient pollution that will protect public health with an *adequate margin of safety*. Under Sections 108-109 of the CAA, Congress mandated that the EPA set national ambient (outdoor) air quality standards for pollutants whose emissions "may reasonably be anticipated to endanger public health (primary standards) or welfare"¹⁷ (secondary standards)" and "the presence of which in the ambient air results from numerous or diverse mobile or stationary sources." The statute also requires that every five years EPA review the latest scientific studies and reaffirm or modify previously established NAAQS.

The 2006 Particulates NAAQS

The EPA's review of PM found that the scientific evidence since 1997 reinforced the associations between exposure to particulates and numerous cardiovascular and respiratory health problems, including aggravated asthma, chronic bronchitis, reduced lung function, irregular heartbeat, nonfatal heart attacks, and premature death. The CASAC found that the numerous epidemiological studies EPA reviewed "have shown statistically significant associations between the concentrations of ambient air PM_{2.5} and PM₁₀ (including levels that are lower than the 1997 particulates NAAQS) and excess mortality and morbidity."¹⁸ Further, the EPA concluded, and most of the CASAC panel concurred, that the scientific evidence supported modifying the particulates standards.

The 1997 primary NAAQS for both PM_{2.5} and PM₁₀ included an *annual* and a *daily* (24-hour) limit. To attain the annual standard, the three-year average of the weighted annual arithmetic mean PM concentration at each monitor within an area must not exceed the maximum limit set by the agency. The 24-hour standards were a concentration-based percentile form, indicating the percentage of the time that a monitoring station can exceed the standard. For example, a 98th percentile 24-hour standard indicates that a monitoring station can exceed the standard 2% of the days during the year.

As modified and published in the October 17, 2006, *Federal Register* Notice, the primary PM_{2.5} and PM₁₀ standards are as follows:

- **PM_{2.5}:** strengthened the *daily* (24-hour) standard, which had allowed no more than 65 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$), by setting a new limit of 35 $\mu\text{g}/\text{m}^3$,

¹⁷ The use of public welfare in the CAA "includes, but is not limited to, effects on soils, water, crops, vegetation, manmade materials, animals, wildlife, weather, visibility, and climate, damage to and deterioration of property, and hazards to transportation, as well as effects on economic values and on personal comfort and well-being, whether caused by transformation, conversion, or combination with other air pollutants" (42 U.S.C. 7602(h)).

¹⁸ CASAC Particulate Matter (PM) review of EPA's *Review of the National Ambient Air Quality Standards for Particulate Matter: Policy Assessment of Scientific and Technical Information (Second Draft PM Staff Paper, January 2005, EPA-SAB-CASAC-05-007, June 6, 2005)*, available on the EPA CASAC website; see "Final Reports by Fiscal Year" at <http://yosemite.epa.gov/sab/sabproduct.nsf/WebReportsbyYearCASAC>.

based on the three-year average of the 98th percentile of 24-hour PM_{2.5} concentrations; retained the *annual* standard at 15 µg/m³.

- **PM₁₀**: retained the *daily* standard at 150 µg/m³ but changes from the 99th percentile to no more than one exceedance per year on average over three years; eliminated the *annual* maximum concentration (50 µg/m³) standard for PM₁₀.¹⁹

For PM_{2.5} and PM₁₀, the secondary (welfare) NAAQS are the same as the primary standards.

Table 1 below provides a comparison of the revised primary NAAQS with those previously promulgated for both PM_{2.5} and PM₁₀.

Table 1. Primary (Health) NAAQS for PM_{2.5} and PM₁₀: Final Revisions (2006), and Previously Promulgated

| | Previous NAAQS | EPA Final Rule (2006) |
|--------------------------|---------------------------------|-----------------------|
| | PM_{2.5} (Fine) | |
| 24-Hour Primary Standard | 65 µg/m ³ | 35 µg/m ³ |
| Annual Primary Standard | 15 µg/m ³ | 15 µg/m ³ |
| | PM₁₀ (Coarse) | |
| 24-Hour Primary Standard | 150 µg/m ³ | 150 µg/m ³ |
| Annual Primary Standard | 50 µg/m ³ | Revoked |

Source: Prepared by the Congressional Research Service with information from EPA’s final particulates NAAQS (71 *Federal Register* 61 143-61233, October 17, 2006), and related technical documents, available at <http://www.epa.gov/air/particles/actions.html>. EPA’s final PM staff paper and the CASAC review of the EPA staff paper are available at http://www.epa.gov/ttn/naqs/standards/pm/s_pm_index.html.

EPA’s final revisions to the standards for fine particulates (PM_{2.5}) were the same as those the agency had proposed in January 2006. However, the 2006 EPA revisions to the PM_{2.5} NAAQS, while tightening the standards, were not as stringent as those recommended by the CASAC and by the EPA staff.

With regard to coarse particulates, the EPA had proposed replacing the current particle size indicator of PM₁₀ with a range of 10 to 2.5 micrometers (PM_{10-2.5}), referred to as inhalable (or thoracic) coarse particles, and setting a PM_{10-2.5} *daily* standard of 70 µg/m³ rather than the current PM₁₀ *daily* standard of 150 µg/m³. The proposal also included narrowing the focus of the PM_{10-2.5} standard to “urban and industrial” sources and excluding particles typical to rural areas, including “windblown dust and soils and particulates generated by agricultural and mining sources.” The range of alternative standards considered and proposed and issues associated with the EPA’s final decisions are discussed later in this report.

¹⁹ Based on the findings in the EPA PM criteria document and staff paper, and the CASAC’s concurrence, that the studies reviewed do not provide sufficient evidence regarding *long-term* exposure to warrant continuation of an annual standard, see 71 *Federal Register* 2653, Section III. *Rationale for Proposed Decision on Primary PM₁₀ Standards*, January 17, 2006.

Implementing the 2006 PM NAAQS²⁰

Promulgation of NAAQS sets in motion a process under which the states and the EPA first identify geographic nonattainment areas, those areas failing to comply with the NAAQS based on monitoring and analysis of relevant air quality data.²¹ Within three years of issuance of a NAAQS, states are required to submit “infrastructure” plans demonstrating that they have the basic air quality management components necessary to implement the NAAQS.²² Following EPA’s final designations of attainment and nonattainment areas, states must submit their plans (State Implementation Plans, or SIPs) for how they will achieve and/or maintain attainment of the standards to EPA. The 2006 tightening of the PM_{2.5} standards resulted in an increase in the number of areas (typically defined by counties or portions of counties) designated nonattainment. The EPA is not requiring new nonattainment designations for PM₁₀ since the standards were not strengthened (see map in **Figure 1**, later in this report, depicting PM₁₀ nonattainment areas).

On November 13, 2009, EPA published its designations of 31 areas in 18 states, comprising 120 counties (89 counties and portions of 31 additional counties) for nonattainment of the revised 2006 24-hour PM_{2.5} standard.²³ The designations, based on 2006 through 2008 air quality monitoring data, include a few counties that would be designated nonattainment for PM_{2.5} for the first time, but the majority of the counties identified overlap with EPA’s final nonattainment designations for the 1997 PM_{2.5} NAAQS. However, most of the 1997 PM_{2.5} nonattainment areas were *only* exceeding the annual standard; thus, tightening the 24-hour standard resulted in an increased number of areas being designated nonattainment based on exceedances of both the 24-hour *and* the annual standard.

On December 22, 2008, EPA had identified 58 areas in 25 states, comprising 211 counties (154 counties and portions of 57 additional counties) for designation as nonattainment for the revised 2006 24-hour PM_{2.5} standard.²⁴ These designations were based on air quality monitoring data for calendar years 2005 through 2007. Publication of a final designation rule for the 2006 PM_{2.5} NAAQS was delayed pending review by the agency under the current Administration. The review of the final designation rule, along with several other agency proposed and final actions introduced toward the end of the previous Administration, was initiated, in part, in response to a White House January 20, 2009, memorandum,²⁵ and the Office of Management and Budget’s subsequent January 21, 2009, memorandum,²⁶ regarding regulatory review. During this review, EPA revised its designations based on more current monitoring data (calendar years 2006-2008).

²⁰ See CRS Report R40096, *2006 National Ambient Air Quality Standards (NAAQS) for Fine Particulate Matter (PM_{2.5}): Designating Nonattainment Areas*, by Robert Esworthy.

²¹ For a general overview of the NAAQS designations process, see EPA’s “Designations” website at <http://www.epa.gov/air/urbanair/designations.html>.

²² Section 110(a)(2) of the Clean Air Act. For a general overview of the NAAQS implementation plans process, see EPA’s “State Implementation Plan Overview” website at <http://www.epa.gov/air/urbanair/sipstatus/overview.html>.

²³ 74 *Federal Register* 58688-58781; see also “Area Designations for 2006 24-Hour Fine Particulate (PM_{2.5}) Standards—Regulatory Actions,” <http://www.epa.gov/pmdesignations/2006standards/regs.htm#4>.

²⁴ See “Area Designations for 2006 24-Hour Fine Particulate (PM_{2.5}) Standards—December 2008 Area Status (Not Final Designations),” <http://www.epa.gov/pmdesignations/2006standards/documents/2008-12-22/12-08table.htm>.

²⁵ Memorandum to Heads and Acting Heads of Executive Departments and Agencies from Rahm Emanuel, Assistant to the President and Chief of Staff, regarding Regulatory Review, January 20, 2009, 74 *Federal Register* 4435 January 26, 2009; the memorandum is also available at http://www.whitehouse.gov/omb/assets/information_and_regulatory_affairs/regulatory_review_012009.pdf.

²⁶ Memorandum to Heads and Acting Heads of Executive Departments and Agencies from Peter R. Orzag, Director, (continued...)

Delaying publication of the final designation rule resulted in the delay of the expected effective date, which had been scheduled for April 2009.²⁷ EPA's final nonattainment designation rule became effective December 14, 2009 (30 days from the date of publication).

Three years following formal designation of nonattainment areas, states are required to submit State Implementation Plans (SIPs), which identify specific regulations and emission control requirements that they will adopt to bring an area into compliance.²⁸ In addition to requiring states to submit implementation plans, EPA acts to control NAAQS pollutants through national standards. These may be in the form of regulations of products that might emit the pollutants (particularly fuels and mobile sources, such as automobiles and trucks) and in the form of emission standards for new stationary sources (e.g., utilities, refineries). States would be required to meet the 2006 PM_{2.5} standard no later than five years from the effective date of designations—December 14, 2014, according to EPA's timeline—or no later than 10 years if qualified for an extension.

On June 9, 2010, EPA published a finding that 23 states, the District of Columbia, and five territories failed to submit complete “infrastructure” SIPs required within three years of promulgation of the NAAQS.²⁹ EPA's findings notice addresses the first two of four elements under section 110(a)(2)(D)(i) to satisfy nonattainment and transport requirements. These two elements require each state to demonstrate adequate provisions for the ability to prohibit air emissions within the state that “(1) contributes significantly to another state's nonattainment of the NAAQS; or (2) interferes with maintenance of a NAAQS.” The findings notice initiates a two-year deadline for EPA to promulgate a Federal Implementation Plan (FIP) unless a state submits, and EPA approves, a plan to meet these two elements prior to the deadline.

Potential Impacts of the 2006 Particulates NAAQS

As discussed above, in setting and revising the NAAQS, the CAA directs the EPA Administrator to protect public health *with an adequate margin of safety*. This language has been interpreted, both by the agency and by the courts, as requiring standards based on a review of the health impacts, without consideration of the costs, technological feasibility, or other non-health criteria.³⁰ Costs and feasibility are generally taken into account in NAAQS implementation (a process that is primarily a state responsibility).

Nevertheless, the EPA released a regulatory impact analysis (RIA) on October 6, 2006,³¹ to meet its obligations under Executive Order 12866 and in compliance with guidance from the White

(...continued)

Office of Management and Budget, regarding Implementation of Memorandum Concerning Regulatory Review, January 21, 2009, http://www.whitehouse.gov/omb/assets/agencyinformation_memoranda_2009_pdf/m09-08.pdf.

²⁷ See EPA's guidance, “Area Designations for 2006 24-Hour PM_{2.5} NAAQS - Technical Information,” http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html.

²⁸ Section 172 of the Clean Air Act. See EPA's “State Implementation Plan Overview” website at <http://www.epa.gov/air/urbanair/sipstatus/overview.html>.

²⁹ 75 *Federal Register* at 32673-32676, June 9, 2010.

³⁰ With regard to the non-relevance of cost considerations, see generally *Whitman v. American Trucking Associations*, 531 U.S. 457, 465-472, 475-76 (2001).

³¹ EPA's Regulatory Impact Analysis (RIA) of the 2006 National Ambient Air Quality Standards for Fine Particle Pollution (PM_{2.5}), available at <http://www.epa.gov/ttn/ecas/ria.html>.

House Office of Management and Budget.³² The RIA only analyzed the benefits and costs of implementing the PM_{2.5} NAAQS. Citing time, data, and modeling limitations, the EPA did not analyze the benefits and costs of retaining the PM₁₀ standard.

The EPA emphasized that the October 2006 RIA differed from typical RIAs in that it did not analyze the regulatory impact of a specific action, and that it is primarily for illustrative purposes. The basis for the benefits calculations are reductions in ambient concentrations of PM_{2.5} resulting from a reasonable, but speculative, array of cost-effective state implementation strategies selected by the EPA for purposes of analysis. The analysis does not model the specific actions that each state will undertake in implementing the 2006 PM_{2.5} NAAQS. The EPA includes a detailed discussion of the limitations and uncertainties associated with the analysis.

In its impact analysis, EPA's estimated baseline case incorporated expected impacts of other national regulations that contribute to lowering PM_{2.5} concentrations in future years. These other regulations included those addressing emissions from the power generation sector, namely the 2005 Clean Air Interstate Rule (CAIR).³³ However, in a July 11, 2008, decision (*North Carolina v. EPA*), the U.S. Court of Appeals for the D.C. Circuit vacated CAIR in its entirety.³⁴ On December 23, 2008, the court modified its decision, allowing CAIR to remain in effect until a new rule is promulgated by EPA.³⁵ CAIR was expected to serve as the primary tool to assist downwind states in meeting the PM_{2.5} (and 8-hour ozone) NAAQS by mitigating interstate transport of sulfur dioxide (SO₂) and nitrogen oxide (NOx) emissions from electric generating units that contribute to the formation of PM_{2.5}.³⁶

On August 2, 2010, EPA published a proposed "Transport Rule" intended to supersede the current CAIR.³⁷ The proposed rule would limit sulfur dioxide (SO₂) and nitrogen oxide (NOx) emissions from electric generating units within 31 states in the eastern United States and the District of Columbia that affect the ability of downwind states to attain and maintain compliance with the 1997 and 2006 PM_{2.5} and the 1997 ozone NAAQS. The proposal includes modifications in response to the Court's concerns, particularly with regard to certain aspects of emissions contributing to ozone.³⁸ The implications of this proposal have already generated considerable debate among states, industry, and other stakeholders, and have been the topic of further deliberation by Congress. The Senate Committee on Environment and Public Works Subcommittee on Clean Air and Nuclear Safety held a hearing on EPA's proposed alternative

³² 58 *Federal Register* 51735, October 4, 1993. See the White House OMB website, *Regulatory Matters*, at http://www.whitehouse.gov/omb/regulatory_affairs/default.

³³ CAA, 42 U.S.C. 7401 et seq., 70 *Federal Register* 25162, May 12, 2005.

³⁴ 531 F.3d 896 (D.C. Cir. 2008). See CRS Report RL34589, *Clean Air After the CAIR Decision: Multi-Pollutant Approaches to Controlling Powerplant Emissions*, by James E. McCarthy, Larry Parker, and Robert Meltz.

³⁵ 550 F.3d 1176 (D.C. Cir. 2008).

³⁶ Sulfur dioxide (SO₂) is a precursor (a pollutant that is transformed in air to form another air pollutant) contributing to the formation of PM_{2.5} concentrations, and NOx is a precursor contributing to the formation of both ozone and PM_{2.5} concentrations. EPA has concluded that SO₂ and NOx emissions, through the phenomenon of air pollution transport, contribute significantly to downwind nonattainment, or interfere with maintenance, of the PM_{2.5} and 8-hour ozone NAAQS (70 *Federal Register* 25162, May 12, 2005).

³⁷ 75 *Federal Register* 45210-45565, August 2, 2010. See also U.S. EPA, "Air Transport" website at <http://www.epa.gov/airtransport/actions.html#jul10>. EPA announced the release of the proposal on July 6, 2010.

³⁸ According to the fact sheet accompanying the proposal, EPA plans to propose a separate transport rule to address the 2010 ozone standard in 2011 (see footnote 37).

transport rule on July 22, 2010.³⁹ EPA has scheduled three public hearings,⁴⁰ and comments on the proposal must be received on or before October 1, 2010.

EPA's Monetized Benefits and Cost Estimates⁴¹

The EPA estimated incremental costs of attaining the revised PM_{2.5} standard based on a set of assumptions and extrapolations regarding currently designated nonattainment areas, likely control strategies and technologies and their associated engineering costs, emissions inventories and sources, and regional variability. The EPA emphasized that the technologies and control strategies selected for analysis only illustrate one way for nonattainment areas to reach attainment, and that states will compile and evaluate a variety of programs and adopt those attainment strategies best suited for their specific local conditions. For purposes of comparing costs with monetized benefits, the EPA estimated that the total annual mean social cost of attainment of the revised PM_{2.5} NAAQS incremental to attainment of the 1997 standards would be \$5.4 billion in 2020.

EPA's estimates of the monetized benefits of complying with the revised PM_{2.5} standard reflect the valuation associated with predicted reductions in the incidence of certain health and social welfare effects. In the RIA, the EPA presented a variety of benefits estimates based on morbidity impacts derived from several published epidemiological studies,⁴² and mortality impacts derived from an American Cancer Society (ACS) Study⁴³ used in previous RIAs, the Harvard Six Cities Study,⁴⁴ and an expert elicitation study conducted by the EPA in 2006.⁴⁵ **Table 2** below presents a range of EPA's estimated economic costs, monetized benefits, and net benefits associated with achieving the revised 2006 PM_{2.5} NAAQS.

³⁹ Senate Committee on Environment and Public Works, Subcommittee on Clean Air and Nuclear Safety hearing: "Oversight: EPA's Proposal for Federal Implementation Plans to Reduce Interstate Transport of Fine Particulate Matter and Ozone," July 22, 2010, <http://epw.senate.gov/public/index.cfm?FuseAction=Hearings.Home>. EPA announced the release of the "Air Transport Rule" on July 6, 2010, but it was not published in the *Federal Register* until August 2, 2010.

⁴⁰ The hearings were scheduled for Thursday, August 19, 2010, in Chicago, Illinois, on Thursday, August 26, 2010, in Philadelphia, Pennsylvania, and on Wednesday, September 1, 2010, in Atlanta, Georgia, 75 *Federal Register* 45075-45076, August 2, 2010.

⁴¹ U.S. EPA, EPA's RIA of the 2006 NAAQS for Fine Particle Pollution (PM_{2.5}), available at <http://www.epa.gov/ttn/ecas/ria.html>.

⁴² The studies from which EPA health effect estimates are drawn are listed in Table 5-7 of the RIA for the 2006 PM_{2.5} NAAQS.

⁴³ Pope, C. Arden, III, et al. "Particulate Air Pollution as a Predictor of Mortality in a Prospective Study of U.S. Adults." *American Journal of Respiratory and Critical Care Medicine* 151 (1995): 669-674.

⁴⁴ Dockery, Douglas W., et al. "An Association Between Air Pollution and Mortality in Six U.S. Cities." *New England Journal of Medicine* 329 (1993): 1753-1759. See also the Health Effects Institute, "Statement: Synopsis of the Particle Epidemiology Reanalysis Project." *Reanalysis of the Harvard Six Cities Study and the American Cancer Society Study of Particulate Air Pollution and Mortality*, July 2000 (includes November 1, 2001 errata sheet), p. I, <http://pubs.healtheffects.org/getfile.php?u=271>.

⁴⁵ See Chapter 5 of the EPA's October 6, 2006, RIA <http://www.epa.gov/ttn/ecas/ria.html>.

Table 2. EPA's Estimated Total Annual Monetized Benefits and Costs of Attaining Alternative PM_{2.5} NAAQS in 2020
(1999 \$ in billions)

| 2006 PM _{2.5} NAAQS (15/35 µg/m ³) | | | | | |
|--|--|--|-------|---------------------------|-----------|
| Discount Rate | Full Benefits | | Cost | Net Benefits ^a | |
| <i>Benefits based on American Cancer Society Study Mortality Function and Published Scientific Literature Morbidity Functions</i> | | | | | |
| 3% | \$17 <i>confidence interval</i> (\$4 - \$36) | | \$5.4 | \$12 | |
| 7% | \$14.5 <i>confidence interval</i> (\$3.5 - \$31) | | \$5.4 | \$9 | |
| <i>Benefits Range based on Expert Elicitation Derived Mortality Function and Published Scientific Literature Morbidity Functions</i> | | | | | |
| | Low Mean | High Mean | | Low Mean | High Mean |
| 3% | \$9 <i>lower bound</i> (\$0.8 - \$42) | \$76 <i>upper bound</i> (\$19 - \$150) | \$5.4 | \$3.5 | \$70 |
| 7% | \$8 <i>lower bound</i> (\$0.8 - \$36) | \$64 <i>upper bound</i> (\$16 - \$130) | \$5.4 | \$2.4 | \$59 |

Source: Prepared by the Congressional Research Service using data from the Environmental Protection Agency's Regulatory Impact Analysis (RIA) of the 2006 National Ambient Air Quality Standards for Fine Particle Pollution (PM_{2.5}); see Table ES-1, p. ES-7; Table ES-3, p. ES-9; Table 5-1, p. 5-3, Table 9-1, p. 9-2. <http://www.epa.gov/ttn/ecas/ria.html>. Estimates and results are as reported by EPA and have been rounded after calculation.

Note: Results are rounded to two significant digits after calculation for presentation and computation as reported by EPA. Estimates (costs and benefits) reflect full attainment in 2020, which includes implementation of several national programs and are incremental to compliance with the 1997 PM_{2.5} NAAQS. The discount rates are as recommended in the EPA's *Guidelines for Preparing Economic Analyses (2000)* and OMB Circular A-4 (2003).

a. For purposes of calculating net benefits, EPA uses the total social cost estimate, which is slightly higher than the engineering cost.

The EPA estimated the total annual monetized benefits of attaining the revised PM_{2.5} NAAQS would range from \$15 billion to \$17 billion based on the mortality function from the ACS study and morbidity function from the published epidemiology studies. Using the mortality function developed from the expert elicitation in conjunction with the morbidity function from the published studies, the EPA's total annual benefits are estimated to range from \$8 billion to \$76 billion in 2020. The EPA's estimated monetized benefits for 2020, like the cost estimates, were based on the EPA's projected compliance schedule and are incremental to compliance with the 1997 PM_{2.5} NAAQS by 2015.

According to the October 2006 RIA the estimated total annual health and welfare net benefits (subtracting social costs from the monetized benefits) in 2020 of attaining the 2006 PM_{2.5} NAAQS ranged from \$9 billion to \$12 billion based on modeling of morbidity and mortality using published epidemiology studies. The benefits ranged from \$2.4 billion to \$70 billion, based on derivation mortality from expert elicitation and morbidity from the epidemiology studies. The ranges of estimates are forecasted using discount rates of 3% and 7%.

The EPA's benefits and cost estimates were in terms of 1999 dollars and were incremental to the agency's modeled attainment strategy for the 1997 PM_{2.5} NAAQS by 2015. The baseline case incorporated expected impacts associated with implementation of national regulations addressing emissions from the power generation sector, including the CAIR,⁴⁶ as well as regulation of various mobile sources, that contribute to lowering PM_{2.5} concentrations in future years.

In addition to the monetized health benefits estimates, the EPA estimated the monetary benefits associated with improvements in visibility in selected Class I national parks and wilderness areas.⁴⁷ The EPA primarily used a stated preference approach which estimates values based on sampling surveys asking people what amount of compensation would be equivalent to a defined improvement in environmental quality. Extrapolating the results of a study based on a 1988 survey on recreational visibility value, the EPA estimated visibility "willingness to pay" benefits to be \$530 million in 2020 with attainment of the 2006 PM_{2.5} NAAQS.⁴⁸

EPA estimated the cost and benefits of a more stringent alternative PM_{2.5} for purposes of comparative analysis. The comparative results are discussed in the "Potential Concerns and Issues" section of this report.

Potential Health Impacts

The EPA health effects estimates were a primary component of its derivations of the monetized benefits discussed above. For purposes of illustration, **Table 3** summarizes the EPA's predicted reductions in the incidence of a range of adverse health effects annually in 2020 for the 2006 PM_{2.5} NAAQS, as reported in its RIA. The range of the estimated mean number of reductions in premature deaths is based on the EPA's derivations using the ACS and the Harvard Six-Cities studies. EPA's mean estimates for the remaining adverse health effects were based on various epidemiology studies.⁴⁹

⁴⁶ 70 *Federal Register* 25162, May 12, 2005.

⁴⁷ Defined as areas of the country such as national parks, national wilderness areas, and national monuments that have been set aside under Section 162(a) of the Clean Air Act to receive the most stringent degree of air quality protection.

⁴⁸ See Appendix I in *Visibility Benefits Methodology* of the EPA's October 6, 2006, RIA <http://www.epa.gov/ttn/ecas/ria.html>.

⁴⁹ See Table 5-7 in Chapter 5 of the EPA's October 6, 2006, RIA: <http://www.epa.gov/ttn/ecas/ria.html>.

Table 3. EPA's Predicted Reductions in Adverse Health Effects Annually in 2020 Associated with Meeting the 2006 PM_{2.5} NAAQS

| Adverse Health Effect | Predicted Reductions ^a (estimated mean) |
|--|---|
| Premature deaths in individuals with preexisting cardiovascular and respiratory disease | 2,500 to 5,700 ^b |
| Cases of chronic bronchitis (age >25) | 2,600 |
| Cases of acute bronchitis (age 8-12) | 7,300 |
| Nonfatal heart attacks (age >71) | 5,000 |
| Hospital admissions for cardiovascular or respiratory symptoms (age >17) | 1,630 |
| Emergency room visits for asthma (age <19) | 1,200 |
| Cases of aggravated asthma (asthmatics age 6-18) | 51,000 |
| Cases of upper and lower respiratory symptoms (asthmatics age 6-18) | 97,000 |
| Days when individuals miss work (age 18-75) | 350,000 |
| Days when individuals must restrict their activities because of symptoms related to particle pollution (age 18-65) | 2,000,000 |

Source: Prepared by the Congressional Research Service with data based on mortality and epidemiology studies presented in Chapter 5 of the Environmental Protection Agency *Regulatory Impact Analysis of the 2006 National Ambient Air Quality Standards for Fine Particle Pollution (PM_{2.5})* Oct. 6, 2006, and available on the EPA's website at <http://www.epa.gov/ttn/ecas/ria.html>. Estimates are rounded by EPA.

- a. For consistency with the emissions and benefits modeling, the EPA used national population estimates based on the U.S. Census Bureau projections. U.S. Bureau of Census, 2000. Population Projections of the United States by Age, Sex, Race, Hispanic Origin and Nativity: 1999 to 2100. Population Projections Program, Population Division, U.S. Census Bureau, available at <http://www.census.gov/population/projections/nation/summary/np-t.txt>.
- b. The range of premature death estimates reflects the mean estimates derived from the American Cancer Society study and the Harvard Six-Cities Study, respectively.

The EPA also estimated reductions in premature mortality based on the expert elicitation approach discussed above. The estimates were variable from expert to expert, ranging from a mean of 1,200 to 13,000 avoided premature deaths annually in 2020 resulting from attainment of the 2006 standards (15/35 µg/m³) incremental to the EPA's baseline strategy for the 1997 PM_{2.5} NAAQS (15/65 µg/m³).

When promulgating the 1997 PM_{2.5} NAAQS, the EPA estimated that compliance would result in the annual prevention of 15,000 premature deaths, 75,000 cases of chronic bronchitis, and 10,000 hospital admissions for respiratory and cardiovascular disease, as well as other benefits. These estimates have been the subject of significant debate and re-analysis. Since 1998, with dedicated funding from Congress, the EPA accelerated its research and re-analysis on PM_{2.5} to better understand the potential associated health effects and to develop ways to reduce risks.⁵⁰ The funding supported EPA intramural and extramural PM research projects and the establishment of five university-based PM research centers around the country.

⁵⁰ Congress increased EPA's appropriations for particulate matter research from \$18.8 million in FY1997 (H.Rept. 104-812) to \$49.6 million in FY1998 (H.Rept. 105-297). PM research appropriations averaged more than \$60 million per year from FY1999 through FY2004, and Congress provided \$60.5 million for FY2005. Congress has not identified PM research funding since FY2005.

According to the February 2010 EPA report entitled *Our Nation's Air: Status and Trends Through 2008*,⁵¹ nationally, annual and 24-hour PM_{2.5} concentrations were 17% and 19% lower, respectively, in 2008 compared to 2001. Based on a comparison of results from PM_{2.5} monitoring locations (565 sites) for two three-year periods, 2001-2003 and 2006-2008, EPA reported that almost all sites showed a decline or little change in PM_{2.5} concentrations.

Of the 565 monitoring sites, EPA reported that 16 sites in California, Illinois, Indiana, Michigan, Ohio, Utah, and West Virginia showed the greatest decreases in annual PM_{2.5} concentrations, and five sites in California, Montana, Oregon, Pennsylvania, and Utah showed the greatest decrease in 24-hour PM_{2.5} concentrations. Four monitoring sites located in Montana, Arizona, and Wisconsin showed the greatest increase in annual PM_{2.5} concentrations, but none were above the annual PM_{2.5} NAAQS standard for the most recent three-year period (2006-2008). Nineteen sites located throughout all regions of the United States showed an increase in 24-hour PM_{2.5} concentrations. Seven of these sites are located in or near metropolitan areas in Arizona, California, Georgia, Montana, Virginia, and Washington were above the 24-hour PM_{2.5} NAAQS standard for the most recent three-year period.

Most of the areas that showed the greatest improvement were the ones that generally had the highest concentrations in the earlier years. Despite the reported overall progress, in 2008 nearly 37 million people lived in counties with measured concentrations exceeding the annual and the 24-hour PM_{2.5} national air quality standards, according to the EPA trends report.⁵²

The EPA's review leading up to the promulgation of the 2006 particulates NAAQS increased its confidence in earlier findings associating exposure to PM_{2.5} with increases in respiratory health problems, hospitalizations for heart and lung disease, and premature death, particularly for children, the elderly, and those with preexisting heart and lung disease.⁵³ However, as referenced earlier, recently released EPA draft assessments and CASAC's review of these assessments⁵⁴ in support of the next round of the agency's periodic review of the particulates NAAQS bring into question whether the current standards provide an adequate margin of safety for protecting public health.

⁵¹ EPA-454/R-09-002, February 2010 <http://www.epa.gov/airtrends/2010/index.html>.

⁵² Refers to trends in the measured PM_{2.5} concentrations relative to their air quality standards in those areas where monitors are located across the country, and does not reflect all designated nonattainment areas. Comparatively, the combined population residing in EPA's final nonattainment designation areas for the 1997 PM_{2.5} NAAQS, consisting of 208 counties in 20 states and the District of Columbia, is almost 90 million.

⁵³ EPA criteria and technical documents in support of the October 17, 2006, final particulates NAAQS, the December 20, 2005, proposal, and the 1997 NAAQS, are available at http://www.epa.gov/ttn/naaqs/standards/pm/s_pm_index.html.

⁵⁴ See footnote 15 and footnote 1651.

Potential Concerns and Issues

Congress and a wide variety of stakeholders closely followed the development of the 2006 particulates NAAQS since EPA's review began nearly 10 years ago. Congressional hearings were held regarding implementation and review of the particulates NAAQS.⁵⁵ Well before the EPA formally proposed revising the particulates NAAQS, stakeholders were providing evidence and arguments at public hearings and other forums for their preferred recommendations. In general, business and industry opposed more stringent standards, and public health and environmental interest groups advocated tighter standards. The EPA received thousands of comments during various stages of development of the particulates criteria document and in response to drafts of the EPA particulates staff paper. The agency reported receiving more than 120,000 comments in response to the January 2006 particulates NAAQS proposal.

The Administrator's proposed and final decisions represented the first time in the nearly 30-year history of the Clean Air Scientific Advisory Committee (CASAC) that the promulgated standards fell outside of the range of the scientific panel's recommendations.⁵⁶ In letters dated March 21, 2006, and September 29, 2006, the CASAC raised its concerns and objections regarding both PM₁₀ and PM_{2.5} proposed standards.⁵⁷

The Administrator is not required by statute to follow CASAC's recommendations; the CAA (in Section 307(d)(3)) requires only that the Administrator set forth any pertinent findings, recommendations, and comments by CASAC and the National Academy of Sciences, and, if the Administrator's proposal differs in an important respect from any of their recommendations, provide an explanation of the reasons for such differences. Courts, in reviewing EPA regulations, also generally defer to the Administrator's judgment on scientific matters, focusing more on issues of procedure, jurisdiction, and standing. Nevertheless, CASAC's detailed objections to the Administrator's decisions and its description of the process as having failed to meet statutory and procedural requirements could play a role in the debate regarding the EPA's reviews of NAAQS.

Petitions Challenging the 2006 PM NAAQS and the D.C. Circuit's February 24, 2009, Decision⁵⁸

In December 2006, a diverse mix of petitioners, including states and state agencies,⁵⁹ environmental and public health organizations, and groups representing various industry and

⁵⁵ U.S. Senate Committee on Environment and Public Works, full Committee, *The Science and Risk Assessment Behind the EPA's Proposed Revisions to the Particulate Matter Air Quality Standards*, July 19, 2006; Subcommittee on Clean Air, Climate Change, and Nuclear Safety, *EPA's Proposed Revisions to the Particulate Matter Air Quality Standards*, July 13, 2006, and *Implementation of the Existing Particulate Matter and Ozone Air Quality Standards*, November 10, 2005.

⁵⁶ For a discussion of issues regarding the CASAC, see CRS Report RL33807, *Air Quality Standards and Sound Science: What Role for CASAC?*, by James E. McCarthy.

⁵⁷ Letter of Dr. Rogene Henderson, Chair, Clean Air Scientific Advisory Committee, to the Hon. Stephen Johnson, Administrator, U.S. EPA, March 21, 2006, EPA-CASAC-LTR-06-002, available at [http://yosemite.epa.gov/sab/sabproduct.nsf/CD706C976DAC62B3852571390081CC21/\\$File/casac-ltr-06-002.pdf](http://yosemite.epa.gov/sab/sabproduct.nsf/CD706C976DAC62B3852571390081CC21/$File/casac-ltr-06-002.pdf); and letter of Dr. Rogene Henderson, Chair of the Clean Air Scientific Advisory Committee, et al. to Hon. Stephen L. Johnson, EPA Administrator, September 29, 2006, EPA-CASAC-LTR-06-003, available at [http://yosemite.epa.gov/sab/sabproduct.nsf/1C69E987731CB775852571FC00499A10/\\$File/casac-ltr-06-003.pdf](http://yosemite.epa.gov/sab/sabproduct.nsf/1C69E987731CB775852571FC00499A10/$File/casac-ltr-06-003.pdf).

⁵⁸ See footnote 10.

agriculture interests, petitioned the U.S. Court of Appeals for the D.C. Circuit to review EPA's 2006 final rule revising the PM NAAQS. The court consolidated the cases.⁶⁰

The petitioners, who challenged aspects of both the fine and coarse PM standards, were joined by various interveners and amici. Decisions regarding PM_{2.5} standard focused primarily on the annual standard. Although the court's February 24, 2009, decision remanded aspects of the EPA's decisions regarding the primary annual NAAQS for PM_{2.5} to the agency for reconsideration, it did not vacate the annual standard, stating: "First, the EPA's failure adequately to explain itself is in principle a curable defect. Second, vacating a standard because it may be insufficiently protective would sacrifice such protection as it now provides, making the best an enemy of the good."⁶¹

Although aspects of the 2006 PM standard remanded to EPA for reconsideration by the court remain in effect and the EPA's tightening of the 24-hour PM_{2.5} standard was not affected, EPA's review of the standards, in part in response to the court's decision, has resulted in the delay of the implementation process. EPA's actions in response to the decision may have longer-term implications, particularly if the agency further tightens the primary or secondary annual standards. Although speculative at best, such actions could require modifications to SIPs submitted by existing previously designated nonattainment areas.

Additionally, the next round of the periodic review of the particulates NAAQS, which is under way, may also have implications with regard to implementation of the 2006 standards. EPA has targeted February 2011 for proposing any changes to the standards, and October 2011 for final standards according to the August 2, 2010, *Federal Register* notice announcing the agency's proposed "Transport Rule."⁶²

The following sections summarize key areas of concern and include brief discussions of the D.C. Circuit's February 24, 2009, decision as it pertains to the particular area.

Fine Particulate (PM_{2.5}) Primary (Health) Standards

The final 2006 revised PM_{2.5} NAAQS, were not as stringent as the levels recommended by the independent CASAC and those recommended by EPA professional staff, as noted above. EPA staff and CASAC recommendations for PM_{2.5} included a range of levels more stringent than those proposed in January and finalized in September of 2006. In particular, the majority of the CASAC panel "did not endorse the option of keeping the annual standard at its present value."⁶³ According to the CASAC:

Of the options presented by EPA staff for lowering the level of the PM standard, based on the above considerations and the predicted reductions in health impacts derived from the risk analyses, most Panel members favored the option of setting a 24-hour PM_{2.5} NAAQS at

(...continued)

⁵⁹ New York, California, Connecticut, Delaware, Illinois, Maine, New Hampshire, New Jersey, New Mexico, Oregon, Pennsylvania, Rhode Island, Vermont), the District of Columbia, and the South Coast Air Quality Management District

⁶⁰ See footnote 12.

⁶¹ See footnote 10.

⁶² Page 45220 of EPA Proposed Rule: Federal Implementation Plans to Reduce Interstate Transport of Fine Particulate Matter and Ozone, or "Proposed Transport Rule," as published in 75 *Federal Register* 45210–45465, August 2, 2010.

⁶³ CASAC PM Review Panel report, p. 7, June 2005, http://www.epa.gov/ttn/naaqs/standards/pm/s_pm_index.html.

concentrations in the range of 35 to 30 $\mu\text{g}/\text{m}^3$ with the 98th percentile form, in concert with an annual NAAQS in the range of 14 to 13 $\mu\text{g}/\text{m}^3$.⁶⁴

Table 4 below compares the CASAC and EPA staff recommendations for PM_{2.5} primary standards, the 1997 standards, and 2006 standards as proposed and promulgated.

Table 4. PM_{2.5} Primary (Health) NAAQS: Final (2006), Proposed and Alternatives, and as Promulgated in 1997

| PM _{2.5} NAAQS Options | 24-hour Primary (98 th percentile) | Annual Primary (arithmetic mean) |
|----------------------------------|--|----------------------------------|
| 1997 NAAQS | 65 $\mu\text{g}/\text{m}^3$ | 15 $\mu\text{g}/\text{m}^3$ |
| EPA staff paper (December 2005) | mid to lower range of 35-25 $\mu\text{g}/\text{m}^3$ | 15 $\mu\text{g}/\text{m}^3$ |
| | or | |
| | mid to lower range of 40-30 $\mu\text{g}/\text{m}^3$ | 14-12 $\mu\text{g}/\text{m}^3$ |
| CASAC (December 2005) | 35-30 $\mu\text{g}/\text{m}^3$ | 14-13 $\mu\text{g}/\text{m}^3$ |
| EPA Proposed Rule (January 2006) | 35 $\mu\text{g}/\text{m}^3$ | 15 $\mu\text{g}/\text{m}^3$ |
| EPA Final Rule (October 2006) | 35 $\mu\text{g}/\text{m}^3$ | 15 $\mu\text{g}/\text{m}^3$ |

Source: Prepared by the Congressional Research Service (CRS), with information from the EPA's final 2006 particulates NAAQS (71 *Federal Register* 61143-61233, Oct. 17, 2006), the EPA's proposed particulates NAAQS (71 *Federal Register* 2620, Dec. 20, 2005), and related technical documents,⁶⁵ available at <http://www.epa.gov/air/particles/actions.html>.

In response to the discrepancies between the proposal and the CASAC recommendations, EPA Administrator Stephen Johnson indicated that his decision required consideration of a number of factors and “judgment based upon an interpretation of the evidence.” The Administrator relied on the evidence of long-term exposure studies as the principal basis for retaining the annual PM_{2.5} standard.⁶⁶ CASAC strongly disagreed with the Administrator’s decision regarding the PM_{2.5} annual standard and took the unprecedented step of urging reconsideration of the proposal.⁶⁷

Many public comments received on the EPA’s proposed revisions to the PM_{2.5} standards, most frequently from environmental and public health organizations, medical doctors and researchers, and the association representing state air quality regulators,⁶⁸ argued for standards as stringent or more stringent than those recommended by CASAC. In contrast, another group of commenters, generally representing industry associations and businesses, opposed revising the 1997 PM_{2.5}

⁶⁴ See footnote 63.

⁶⁵ EPA’s final PM staff paper and the CASAC review of the EPA staff paper (see references earlier in this report).

⁶⁶ For the EPA Administrator’s rationale for proposing to retain the current level for the annual PM_{2.5} standard and recognition of the CASAC’s recommendation not endorsing this approach, see 71 *Federal Register* 2650-2653, January 17, 2006.

⁶⁷ Letter of Dr. Rogene Henderson, Chair, Clean Air Scientific Advisory Committee, to the Hon. Stephen Johnson, Administrator, U.S. EPA, March 21, 2006, EPA-CASAC-LTR-06-002, available at [http://yosemite.epa.gov/sab/sabproduct.nsf/CD706C976DAC62B3852571390081CC21/\\$File/casac-ltr-06-002.pdf](http://yosemite.epa.gov/sab/sabproduct.nsf/CD706C976DAC62B3852571390081CC21/$File/casac-ltr-06-002.pdf); or from the federal docket for the proposed rule Docket ID No. EPA-HQ-OAR-2001-0017, on the Federal Docket website <http://www.regulations.gov>.

⁶⁸ CRS communication with Mr. William Becker, Executive Director, State and Territorial Air Pollution Program Administrators/Association of Local Air Pollution Control Officials (STAPPA/ALAPCO), January 5, 2006.

standards, in some cases highlighting different aspects of the same research cited by the CASAC and others supporting tighter standards.⁶⁹ Some who opposed more stringent particulates NAAQS called attention to more recent studies of health effects attributable to particulates that demonstrate risk estimates are lower and less statistically significant than they were in 1997, when the last standard was set.⁷⁰

In Section II of the preamble of the final October 2006 revisions, “Rationale for Final Decisions on Primary PM_{2.5} Standards,” the EPA discussed its final decision with respect to the CASAC recommendations regarding the PM_{2.5} annual standard. The Administrator differed with the CASAC with regard to the level of uncertainty associated with the agency’s quantitative risk assessment and whether the results appropriately served as a primary basis for a decision on the level of the annual PM_{2.5} standard. The Administrator further stressed the emphasis placed on the long-term means of the levels associated with mortality effects in the two key long-term studies⁷¹ in determining the level of the annual standard. CASAC considered the evidence from specific short-term exposure studies as part of the basis for its recommendation for a lower annual standard level. As noted above, the CASAC expressed its objections to the EPA’s final 2006 particulates NAAQS in its September 29, 2006, letter to Administrator Johnson.⁷²

With regard to PM_{2.5}, the letter stated: “CASAC is concerned that the EPA did not accept our finding that the annual PM_{2.5} standard was not protective of human health and did not follow our recommendation for a change in that standard.”⁷³ The letter noted that “there is clear and convincing scientific evidence that significant adverse human-health effects occur in response to short-term and chronic particulate matter exposures at and below 15 µg/m³,” and noted that 20 of the 22 Particulate Matter Review Panel members, including all seven members of the statutory committee, were in “complete agreement” regarding the recommended reduction. “*It is the CASAC’s consensus scientific opinion that the decision to retain without change the annual PM_{2.5} standard does not provide an adequate margin of safety ... ‘requisite to protect the public health’ (as required by the Clean Air Act).*”⁷⁴ (Italics in original.)

Petitions from several states and state agencies, as well as the American Lung Association, Environmental Defense, and the National Parks Conservation Association, challenged EPA’s decision not to strengthen the primary annual NAAQS standard for PM_{2.5} (15µg/m³). Their challenges were based, in part, on the agency’s reliance primarily on long-term exposures and lack of consideration of vulnerable populations. The D.C. Circuit concluded that EPA failed adequately to explain why, in view of the risks posed by short-term exposures and the evidence of morbidity resulting from long-term exposures, its annual standard of 15µg/m³ is “requisite to protect health [with] an adequate margin of safety,” including the health of vulnerable

⁶⁹ For EPA’s discussion and response to several of these comments, see 71 *Federal Register* 61143-61233, October 17, 2006, Part II *Rationale for Final Decisions on Primary PM_{2.5} Standards*, Sections B and F, at <http://epa.gov/pm/actions.html>.

⁷⁰ CRS communication with Mr. Frank Maisano, Media Contact for the Electric Reliability Coordinating Council, January 17, 2006.

⁷¹ 71 *Federal Register* at 2651, January 17, 2006.

⁷² Letter of Dr. Rogene Henderson, Chair of the Clean Air Scientific Advisory Committee, et al. to Hon. Stephen L. Johnson, EPA Administrator, September 29, 2006, available at [http://yosemite.epa.gov/sab/sabproduct.nsf/1C69E987731CB775852571FC00499A10/\\$File/casac-ltr-06-003.pdf](http://yosemite.epa.gov/sab/sabproduct.nsf/1C69E987731CB775852571FC00499A10/$File/casac-ltr-06-003.pdf). Italics in original.

⁷³ *Ibid.*

⁷⁴ *Ibid.*

subpopulations.⁷⁵ In its February 24, 2009, decision, the court granted this part of the petition and remanded the standard to EPA for reconsideration, but did not vacate the standard. The court denied the same petitions with respect to review of the EPA analysis of long-term mortality studies, and its decision not to rely upon the quantitative risk assessment.

Potential Health Benefits of a More Stringent PM_{2.5} Standard

In its RIA, the EPA estimated the nationwide monetized human health and welfare benefits of attaining two suites of PM_{2.5} NAAQS: (1) the revised PM_{2.5} NAAQS, which include the 35 µg/m³ daily (24-hour) standard and the unchanged 15 µg/m³ annual standard, and (2) an alternative standard similar to the least stringent of the CASAC recommendations that includes a tighter annual standard of 14 µg/m³ and the same 35 µg/m³ daily (24-hour) standard. As discussed previously, the EPA presented a variety of benefits estimates based on several epidemiological studies,⁷⁶ the American Cancer Society (ACS) Study⁷⁷ used in previous RIAs, the Harvard Six-Cities Study,⁷⁸ and an expert elicitation study conducted by the EPA in 2006.⁷⁹

The EPA estimated that attainment of the more stringent alternative PM_{2.5} NAAQS would result in \$26 billion to \$30 billion of total annual benefits in 2020, based on the ACS mortality function. This compares to a range of \$15 billion to \$17 billion estimated for compliance with the 2006 PM_{2.5} NAAQS (see **Table 2** and discussion earlier in this report). EPA's estimate of annual benefits derived using the expert elicitation ranged from \$15 billion to \$140 billion for the more stringent alternative, compared to the expert estimates of \$8 billion to \$76 billion for compliance with the 2006 standard. EPA also estimated the monetary benefits ("willingness to pay") associated with improvements in visibility in selected Class I national parks and wilderness areas would be \$1.2 billion in 2020 with attainment of the more stringent alternative PM_{2.5} standard analyzed, compared to \$530 million with attainment of the revised PM_{2.5} NAAQS.⁸⁰ EPA estimated the total annual cost associated with attainment of the alternative PM_{2.5} NAAQS analyzed would be \$7.9 billion in 2020, compared to \$5.4 billion.

For purposes of illustration, **Table 5** below provides a comparison of EPA's predicted reductions annually for the 2006 PM_{2.5} NAAQS (15/35 µg/m³) with a more stringent alternative analyzed (14/35 µg/m³), based on premature mortality estimates derived from the ACS and Harvard Six-Cities studies, and morbidity derived from various epidemiology studies. As discussed previously, a key component of the EPA's monetized benefits estimates are the agency's predicted reductions in the incidence of premature deaths and a range of adverse health effects annually in 2020 associated with compliance of the 2006 PM_{2.5} NAAQS.

⁷⁵ See footnote 10.

⁷⁶ See footnote 49.

⁷⁷ See footnote 43.

⁷⁸ See footnote 44.

⁷⁹ See Chapter 5 of the EPA's October 6, 2006, RIA for more detail <http://www.epa.gov/ttn/ecas/ria.html>.

⁸⁰ See Appendix in I *Visibility Benefits Methodology* of the EPA's October 6, 2006, RIA <http://www.epa.gov/ttn/ecas/ria.html>.

Table 5. EPA's Predicted Reductions in Health Effects Annually in 2020 Associated with Meeting the 2006 PM_{2.5} NAAQS and a More Stringent Alternative Annual Standard, Incremental to Attainment of the 1997 PM_{2.5} Standards

| Adverse Health Effect | PM _{2.5} NAAQS (15/35 µg/m ³) | More Stringent Annual Std. (14/35 µg/m ³) |
|--|---|---|
| | Predicted Reductions ^a (estimated mean) | |
| Mortality | | |
| Premature deaths in individuals with preexisting cardiovascular and respiratory disease | | |
| Based on American Cancer Society and Six Cities Studies | 2,500 to 5,700 ^b | 4,000 to 9,000 ^b |
| Based on Expert Elicitation Results (low and high mean) | 1,200 to 13,000 | 2,200 to 24,000 |
| Morbidity | | |
| Cases of chronic bronchitis (age >25) | 2,600 | 4,600 |
| Cases of acute bronchitis (age 8-12) | 7,300 | 13,000 |
| Nonfatal heart attacks (age >71) | 5,000 | 8,700 |
| Hospital admissions for cardiovascular or respiratory symptoms (age >17) | 1,630 | 3,080 |
| Emergency room visits for asthma (age <19) | 1,200 | 3,200 |
| Cases of aggravated asthma (asthmatics age 6-18) | 51,000 | 79,000 |
| Cases of upper and lower respiratory symptoms (asthmatics age 6-18) | 97,000 | 153,000 |
| Days when individuals miss work (age 18-75) | 350,000 | 550,000 |
| Days when individuals must restrict their activities because of symptoms related to particle pollution (age 18-65) | 2,000,000 | 3,300,000 |

Source: Prepared by the Congressional Research Service with data presented in Chapter 5 of EPA's Agency Regulatory Impact Analysis of the 2006 National Ambient Air Quality Standards for Fine Particle Pollution (PM_{2.5}) Oct. 6, 2006, and available on the EPA's website at <http://www.epa.gov/ttn/ecas/ria.html>. Estimates are as rounded by EPA.

- a. For consistency with the emissions and benefits modeling, the EPA used national population estimates based on the U.S. Census Bureau projections. U.S. Bureau of Census. 2000. Population Projections of the United States by Age, Sex, Race, Hispanic Origin and Nativity: 1999 to 2100. Population Projections Program, Population Division, U.S. Census Bureau, Available at <http://www.census.gov/population/projections/nation/summary/np-t.txt>.
- b. The range of reductions in premature deaths estimates reflect the mean estimates derived from the American Cancer Society study and the Harvard Six-Cities Study, respectively.

As discussed earlier, EPA also used expert elicitation to characterize the concentration response function for the relationship between fine PM and premature mortality. The estimates EPA derived using this approach were variable from expert to expert, ranging from a mean of 2,200 to 24,000 avoided premature deaths annually in 2020 resulting from attainment of the more stringent alternative standard (14/35 $\mu\text{g}/\text{m}^3$) incremental to the EPA's baseline strategy for the 1997 NAAQS (15/65 $\mu\text{g}/\text{m}^3$). For attainment of the 2006 standards (15/35 $\mu\text{g}/\text{m}^3$), EPA estimated 1,200 to 13,000 fewer premature deaths based on the expert elicitation.

Recent EPA assessments⁸¹ in support of the next round of periodic review of the particulates NAAQS have further stimulated the debate and generated considerable comment with regard to further tightening of both the annual and the 24-hour $\text{PM}_{2.5}$ standards. The assessments include findings that indicate that more stringent annual and 24-hour $\text{PM}_{2.5}$ standards could potentially reduce mortality risk from long-term exposure, as well as provide protection from high peak concentrations. In its review of EPA's draft assessments, members of the CASAC support the EPA staff's conclusion that "currently available information clearly calls into question the adequacy of the current standards" and that the staff's recommendation for consideration of a stricter $\text{PM}_{2.5}$ standard are "supported by the epidemiological and toxicological evidence, as well as by other risk and air quality information" compiled by EPA in related scientific assessments.⁸²

Coarse Particulate (PM_{10}) Primary Standards

Particle Size Indicator

The EPA and most of the CASAC panel members concluded that there was a lack of evidence (often a lack of studies) on long-term adverse health effects of specific PM_{10} measurements to support the annual standard, and that there was a specific need to address particles ranging in size from 2.5 to 10 micrometers.⁸³ EPA's January 17, 2006, proposal would have replaced the existing particle size indicator of 10 micrometers (PM_{10}) with an indicator range of 10 to 2.5 micrometers ($\text{PM}_{10-2.5}$), referred to as inhalable (or thoracic) coarse particles, and setting a $\text{PM}_{10-2.5}$ *daily* standard of 70 $\mu\text{g}/\text{m}^3$ rather than the current PM_{10} *daily* standard of 150 $\mu\text{g}/\text{m}^3$. At the time of its proposal, the EPA concluded that the scientific evidence supported the standard based on short-term exposure to certain coarse particles, particularly in urban and industrial areas.

In the final 2006 particulates NAAQS, the EPA decided to maintain the PM_{10} indicator, citing the limited body of evidence on health effects associated with thoracic coarse particles from studies that use $\text{PM}_{10-2.5}$ measurements. The agency also determined that the only studies of clear quantitative relevance to health effects most likely associated with thoracic coarse particles used PM_{10} measurements. The 2006 particulates NAAQS retained the PM_{10} indicator and the *daily* (24-hour) standard of 150 $\mu\text{g}/\text{m}^3$.

⁸¹ See footnote 15.

⁸² See footnote 16.

⁸³ Clean Air Scientific Advisory Committee (CASAC) Review of the EPA Staff Recommendations Concerning a Potential Thoracic Coarse PM Standard in the *Review of the National Ambient Air Quality Standards for Particulate Matter: Policy Assessment of Scientific and Technical Information* (Final PM OAQPS Staff Paper, EPA-452/R-05-005, June 2005), September 15, 2005, EPA-SAB-CASAC-05-007, available on the EPA CASAC website at <http://yosemite.epa.gov/sab/sabproduct.nsf/WebReportsbyYearCASAC>.

In its September 29, 2006, letter, the CASAC said it was “completely surprised” at the decision to revert to the use of PM₁₀ as the indicator for coarse particles, noting that the option of retaining the existing daily PM₁₀ standard was not discussed during the advisory process and that CASAC views this decision as “highly-problematic since PM₁₀ includes both fine and coarse particulate matter.” The CASAC did agree that having a standard for PM₁₀ was better than no standard.

The EPA indicated that it is promulgating a new federal reference method (FRM) for measurement of mass concentrations of PM_{10-2.5} in the atmosphere as the standard of reference for measurements of PM_{10-2.5} concentrations in ambient air. The EPA anticipates that the new FRM should provide a basis for gathering scientific data to support future reviews of the particulates NAAQS.⁸⁴ According to the EPA, these monitors will employ the latest in speciation technology to advance the science, enabling future regulation to provide more targeted protection.

The EPA’s January 17, 2006, proposal to change the indicator of the standard for coarse particles was in response to a 1999 U.S. Court of Appeals for the DC Circuit decision⁸⁵ directing the EPA to ensure that the standard did not duplicate the regulation of fine particles. The agency contends that it addressed the concerns raised by the court regarding PM₁₀ as an indicator for inhalable coarse particulate matter in its rationale in the final 2006 particulates NAAQS, announced September 21, 2006.⁸⁶

In its February 24, 2009, decision,⁸⁷ the D.C. Circuit denied petitions by industry and agricultural groups for review of the primary daily standard for PM₁₀. In their petition, the American Farm Bureau Federation, the National Pork Producers Council, the National Cattlemen’s Beef Association, and the Agricultural Retailers Association challenged the EPA’s decision to retain a daily standard for PM₁₀ including that in nonurban areas. They also challenged the decision to retain the indicator particle size indicator of 10 micrometers (PM₁₀), and the primary daily standard of 150 µg/m³. The court denied the petitions, finding EPA’s decision and explanation on all three issues to be reasonable.

Environmental groups petitioned for review of the EPA’s decision to revoke the primary annual standard for PM₁₀. The D.C. Circuit denied the petition finding EPA’s decision reasonable because the latest scientific evidence, as shown in the Criteria Document and the Staff Paper, do not indicate long-term exposure to coarse particles poses a health risk.

Rural PM₁₀ Sources

In addition to the changes to the coarse particulates indicator, the EPA had proposed focusing the PM_{10-2.5} standard only on “urban and industrial” sources. Particles typical to rural areas including “windblown dust and soils and PM generated by agricultural and mining sources” would not

⁸⁴ 71 *Federal Register* 61143-61233, October 17, 2006, Section VI. *Reference Methods for the Determination of Particulate Matter as PM_{10-2.5} and PM_{2.5}*, <http://epa.gov/pm/actions.html>.

⁸⁵ The EPA’s standard for PM₁₀, as modified by the 1997 changes to the particulates NAAQS, was challenged shortly after promulgation. Concluding that PM₁₀ was a “poorly matched indicator” for thoracic coarse particles because it included the smaller PM_{2.5} category as well as the larger particles, the D.C. Circuit remanded the standard to the EPA (*American Trucking Associations v. EPA*, 175 F.3d 1027, 1054-55 (D.C. Cir. 1999)).

⁸⁶ 71 *Federal Register* 61143-61233, October 17, 2006, Section III.C.3. *Decision Not to Revise PM₁₀ Indicator*, available at <http://epa.gov/pm/actions.html>.

⁸⁷ See footnote 10.

have been subject to this standard. Additionally, the EPA proposed revoking the current 24-hour PM₁₀ standards, except in areas that have 1) monitors indicating violation, and 2) a population of 100,000 or more. The emphasis on urban and industrial areas in the January 2006 proposal was based on the findings reported in the Criteria Document, the PM staff paper, and the CASAC conclusion that “the evidence for the toxicity of PM_{10-2.5} comes from studies conducted primarily in urban areas and is related, in large part, to the re-entrainment of urban and suburban road dusts, as well as primary combustion products.”⁸⁸

The EPA’s proposal to exclude any ambient mix of PM_{10-2.5} that is dominated by rural windblown dust and soils and particulates generated by agricultural and mining sources, and how the EPA would distinguish the sources during its implementation, raised a number of questions and resulted in numerous comments. In response to the proposal, in its March 21, 2006, letter to the EPA Administrator, the CASAC stated that while it had recognized the scarcity of information on the toxicity of rural dust, it “neither foresaw nor endorsed a standard that specifically exempts all agricultural and mining sources, and offers no protection against episodes of urban-industrial PM_{10-2.5} in areas of populations less than 100,000.” The committee strongly recommended “expansion of our knowledge of the toxicity of PM_{10-2.5} dusts rather than exempting specific industries (e.g., mining, agriculture).”⁸⁹

Several Members of the House Committee on Agriculture submitted a letter to EPA Administrator Stephen Johnson in July 2006 conveying support for the agency to maintain its provision to exclude agriculture and mining dust and similar sources of coarse particulates in the particulates NAAQS, as had been proposed.⁹⁰ In the final rule, EPA indicated that with the exception of representatives of those sources that would have been excluded under the proposal (e.g., agriculture and mining), most commenters opposed the exclusion. Those opposed included environmental and public health groups, state and local agencies, and industries not excluded from the proposed indicator (e.g., transportation and construction).

The EPA did not exclude any areas or types of particles in the final 2006 particulates NAAQS revisions, based on further consideration of the data and in response to comments. In its rationale for the final PM₁₀ standard, the EPA continued to acknowledge that there is far more evidence concerning health effects associated with thoracic coarse particles in urban areas than in non-urban areas. However, the EPA also stated that “the existing evidence is inconclusive with regard to whether or not community-level exposures to thoracic coarse particles are associated with adverse health effects in non-urban areas.”⁹¹ The EPA indicated that it would be expanding its research and monitoring programs to collect additional evidence on the differences between coarse particles typically found in urban areas and those typically found in rural areas. The EPA

⁸⁸ CASAC reviews, the PM criteria document, staff paper, and related information, are available at http://www.epa.gov/ttn/naaqs/standards/pm/s_pm_index.html.

⁸⁹ Letter of Dr. Rogene Henderson, Chair, Clean Air Scientific Advisory Committee, to the Hon. Stephen Johnson, Administrator, U.S. EPA, March 21, 2006, EPA-CASAC-LTR-06-002, available at [http://yosemite.epa.gov/sab/sabproduct.nsf/CD706C976DAC62B3852571390081CC21/\\$File/casac-ltr-06-002.pdf](http://yosemite.epa.gov/sab/sabproduct.nsf/CD706C976DAC62B3852571390081CC21/$File/casac-ltr-06-002.pdf), or from the federal docket for the proposed rule Docket ID No. EPA-HQ-OAR-2001-0017, on the Federal Docket website, <http://www.regulations.gov>.

⁹⁰ Letter to EPA Administrator Stephen L. Johnson, from the Chairman, the Ranking Member, and other Members of the House Committee on Agriculture, July 27, 2006.

⁹¹ 71 *Federal Register* 61143-61233, October 17, 2006, Section III.C.3. *Decision Not to Revise PM₁₀ Indicator*, available at <http://epa.gov/pm/actions.html>.

announced the release of a final rule amending its national air quality monitoring requirements on September 27, 2006.⁹²

In contrast to objections regarding other aspects of EPA's final 2006 particulates NAAQS revisions, the CASAC agreed with the EPA decision against including exemptions in its September 29, 2006, letter to the EPA Administrator. However, a number of those representing agriculture interests, including some Members of Congress,⁹³ remained concerned that EPA's decision not to include the exclusions in the final 2006 particulates NAAQS will result in unnecessary burdens on the agricultural community. In its February 24, 2009, decision,⁹⁴ the D.C. Circuit found that EPA provided reasonable explanation for its decisions not to set separate urban and nonurban PM₁₀, rejecting the petitioners challenge to the level of PM₁₀ standard.⁹⁵

Because the PM₁₀ standard was not strengthened no new areas, including rural or non urban areas, will be designated as nonattainment for PM₁₀. To the contrary, a few counties previously designated nonattainment have been determined by EPA to be in attainment since the 2006 revisions to the particulates NAAQS. Additionally, states' nonattainment recommendations for the 2006 PM_{2.5} NAAQS and EPA's August 2008 proposed modifications to these recommendations do not include new rural or non-urban areas. The map in **Figure 1** below shows the status of nonattainment of the PM₁₀ NAAQS.

As depicted on the map, the majority of the United States is in attainment of the PM₁₀ NAAQS (including Hawaii, which is not shown on the map). Since 1990, EPA designated 87 areas as nonattainment with the PM₁₀ NAAQS.⁹⁶ As of July 2009, 40 of the original 87 PM₁₀ areas have been redesignated to attainment. Of the remaining 47 nonattainment areas (40 counties with a population of 25.5 million), 26 areas are currently not meeting the PM₁₀ standard or have insufficient data to determine attainment based on 2005-2007 data. The remaining counties have submitted the required SIPs for PM₁₀ but have not yet been formally redesignated to attainment.⁹⁷

⁹² 71 *Federal Register* 61236-61328, October 17, 2006, at <http://epa.gov/pm/actions.html>.

⁹³ Some Members of the House Committee on Agriculture expressed their concerns with the EPA's final actions with regard to the exemptions at a September 28, 2006, hearing regarding the EPA's pesticide programs. House Committee on Agriculture, Subcommittee on Conservation, Credit, Rural Development, and Research, *Review of the Environmental Protection Agency's Pesticide Program*, September 28, 2006.

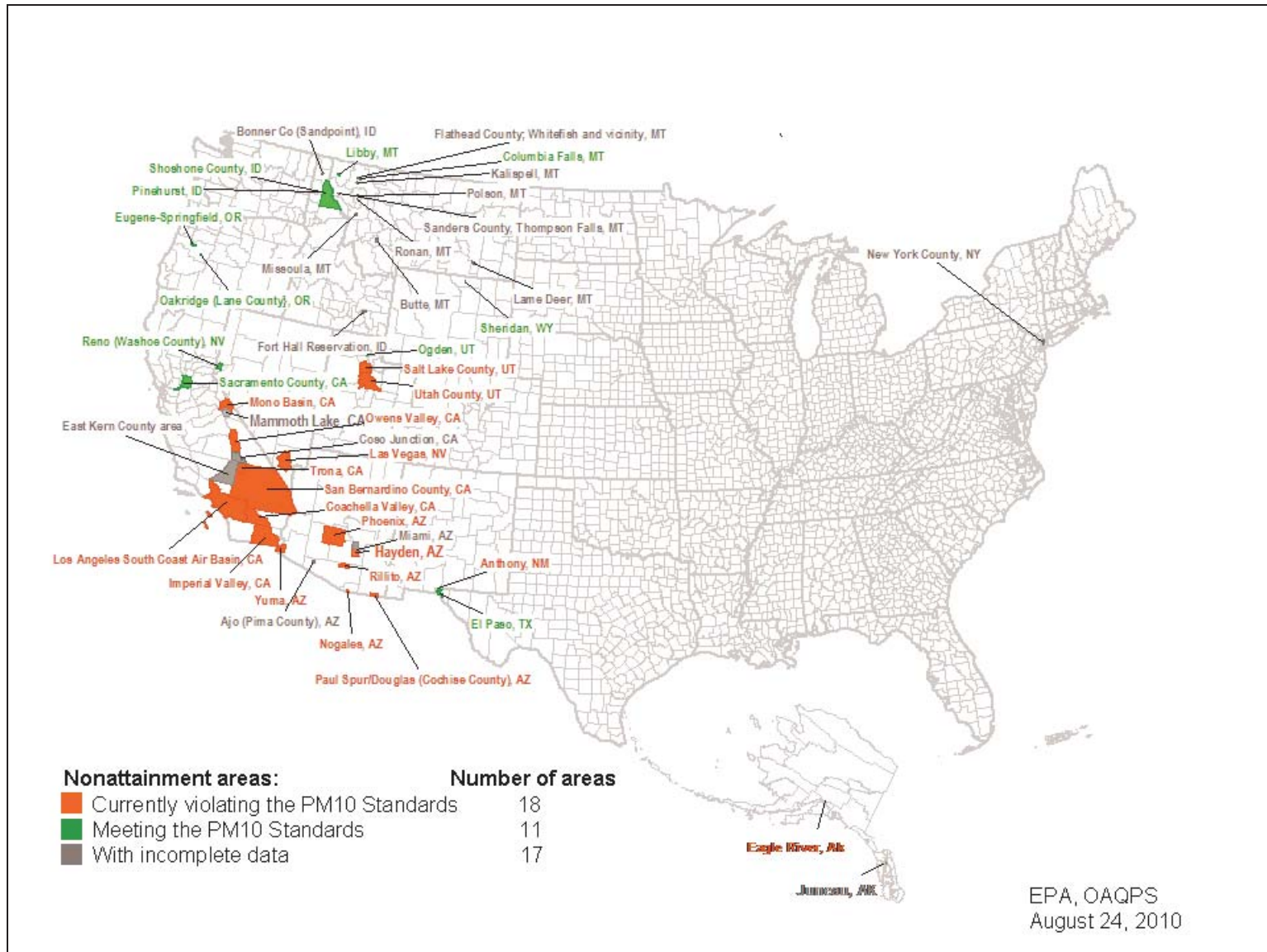
⁹⁴ See footnote 10.

⁹⁵ Part IV of the D.C. Circuit's February 24, 2009 decision. The court also did not reach the question raised by the amicus National Association of Home Builders that EPA does not have the authority to set different NAAQS for urban areas or for different emissions sources.

⁹⁶ See EPA's PM₁₀ designations at <http://www.epa.gov/air/oaqps/greenbk/pindex.html>.

⁹⁷ Information provided directly to CRS by the EPA Office of Air Quality Planning and Standards (OAQPS).

Figure I. Status of Current PM₁₀ Nonattainment Areas, Based on 2004-2006 Air Quality



Source: Updated map provided directly to CRS by the EPA Office of Air Quality Planning and Standards (OAQPS), August 26, 2010. There are no PM₁₀ nonattainment areas in Hawaii, which was not included on the EPA map.

Recent EPA assessments⁹⁸ in support of the next round of periodic review of the particulates NAAQS have further stimulated the debate and generated considerable comment, particularly within the agriculture community, with regard to further tightening the PM₁₀ standards. With regard to the adequacy of the current primary 24-hour PM₁₀ standard EPA staff concluded that consideration should be given to retaining or revising the current standard downward in a June 2010 second external review draft policy assessment. In its August 2010 review of the draft assessment, CASAC recommends that “the primary standard be revised downwards and not retained,” but did not agree that the available scientific evidence strongly supports the EPA staff proposed upper bound standard level of 85µg/m³, favoring a more stringent level to “provide enhanced protection, somewhere in the range of 75 – 65 µg/m³...”⁹⁹

In letters to the EPA Administrator, some Members of Congress have raised their concerns about EPA’s staff recommendations and the potential impacts on agriculture associated with tightening the PM₁₀ standards, encouraging EPA retain the current primary and standards.¹⁰⁰

Secondary PM_{2.5} and PM₁₀ Standards

The EPA proposal, and the final 2006 particulates NAAQS, set the secondary standard for PM₁₀ and for PM_{2.5} at the same level as their primary standard. The PM staff paper and the CASAC both recommended secondary standards at levels different from the primary in order to be more protective of visibility, and the CASAC reiterated the recommendations in its March 21, 2006, and September 29, 2006, letters to the EPA Administrator.

For PM_{2.5}, the EPA PM staff paper and most of the CASAC panel recommended consideration of a sub-daily standard with a level in the range of 20 to 30 µg/m³ for a four- to eight-hour midday time period, with a 92nd to 98th percentile form, as opposed to the primary daily standard at 35 µg/m³, based on the current three-year average of the 98th percentile of 24-hour PM_{2.5} concentrations. Although the CASAC ultimately agreed with setting a secondary standard at the same level as the primary standard based on the coarse particulates indicator PM_{10-2.5}, the committee recommended that the standard not be limited to urban areas, as the EPA had proposed.

In its February 24, 2009, decision,¹⁰¹ the D.C. Circuit granted in full a petition from environmental groups challenging EPA’s decision to set the PM_{2.5} secondary NAAQS for protecting public welfare at the same level as the primary NAAQS for protecting public health. The decision remanded the PM_{2.5} secondary NAAQS to EPA for reconsideration. The court found that EPA unreasonably concluded that the NAAQS are adequate to protect public welfare from adverse effects on visibility.

⁹⁸ See footnote 15.

⁹⁹ See footnote 16.

¹⁰⁰ Letters to EPA Administrator Lisa Jackson: joint letter from 21 Senators, July 23, 2010, <http://grassley.senate.gov/about/upload/Agriculture-07-23-10-dust-letter-to-EPA-signed-version-doc.pdf>; joint letter from Senators Kent Conrad and Byron Dorgan, and Representative Earl Pomeroy, August 5, 2010, <http://conrad.senate.gov/pressroom/record.cfm?id=327070&>.

¹⁰¹ See footnote 10.

In recent assessments in support of the next round of the agency's periodic review of the particulate NAAQS referenced earlier in this report, EPA staff recommends revising the secondary standards for PM_{2.5} based on preliminary review of data.¹⁰²

Exclusion of More Recent Research

A number of stakeholders commented that EPA should have considered certain studies that were published too recently to have been included in the 2004 criteria document that, they argued, increased the uncertainty about possible health risks associated with exposure to particulates. Others contended that there are new studies (some of them the same studies) in support of their arguments for a lower (more stringent) level to protect health. Some who opposed more stringent standards commented that the agency should have delayed its decision regarding the PM NAAQS to take into consideration several of these studies.

At the time of the proposal, the EPA declared its intention to review and evaluate significant new studies developed since 2002, and those published since the close of the criteria document, during the comment period.¹⁰³ With the release of its final 2006 particulates NAAQS, the EPA acknowledged that these studies provided expansion of the science and some insights regarding particulates exposure and related health effects, but determined that the new data “do not materially change any of the broad scientific conclusions regarding the health effects of PM exposure made in the 2004 PM Air Quality Criteria Document.”¹⁰⁴

Conclusions

The EPA's October 17, 2006, promulgation of the final modifications to the existing particulates NAAQS following completion of its statutorily required review sparked interest and conflicting concerns among a diverse array of stakeholders, and in Congress.

As a result of EPA's 2006 tightening the fine particulates (PM_{2.5}) NAAQS, additional areas have been classified as nonattainment and needing to implement new controls on particulate matter in order to comply. States and local governments will be required to develop and implement new or modified plans for addressing emissions in those areas that do not meet the 2006 standards. A stricter standard means increased costs for the transportation and industrial sectors most likely to be affected by particulate matter controls, including utilities, refineries, and the trucking industry. In terms of public health, a stricter standard is expected to result in fewer adverse health effects for the general population and particularly sensitive populations, such as children, asthmatics, and the elderly, with the estimated value of these benefits significantly outweighing the costs.

Because of health and cost implications, NAAQS decisions have been the source of significant concern to some in Congress. The evolution and development of the particulates NAAQS, in particular, have been the subject of extensive oversight. As a result, the D.C. Circuit's February

¹⁰² U.S. EPA, *Particulate Matter Urban-Focused Visibility Assessment - Second External Review Draft* (EPA 452/P-10-002, January 2010), available at http://www.epa.gov/ttn/naaqs/standards/pm/s_pm_2007_risk.html. See also assessments referenced in footnote 15.

¹⁰³ 71 *Federal Register* 2625, January 17, 2006, <http://epa.gov/pm/actions.html>.

¹⁰⁴ 71 *Federal Register* 61143-61233, October 17, 2006, <http://epa.gov/pm/actions.html>.

2009 decision regarding challenges to the 2006 PM NAAQS, delay in implementing the 2006 PM_{2.5} NAAQS as a result of the current Administration's review of the final designations, and preliminary results of initial risk assessments supporting EPA's next round of periodic review of the particulate NAAQS, which is under way, have prompted renewed interest in several of the issues discussed throughout this report.

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