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Implementing EPA's 2015 Ozone Air Quality Standards

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Summary

Implementation of revised ozone standards by the U.S. Environmental Protection Agency (EPA) is now moving forward, after the agency designated 52 areas with just over 200 counties or partial counties and two tribal areas as “nonattainment” for the standards. The standards—formally known as National Ambient Air Quality Standards (NAAQS) for ground-level ozone—are standards for outdoor (ambient) air. In 2015, EPA tightened both the primary (health-based) and secondary (welfare-based) standards from 75 parts per billion (ppb) to 70 ppb after concluding that protecting public health and welfare requires lower concentrations of ozone than were previously judged to be safe. Ozone aggravates heart and lung diseases and may contribute to premature death; the primary standard addresses these concerns. Ozone can also have negative effects on forests and crop yields, which the secondary NAAQS is intended to protect.

The designated nonattainment areas include counties in 22 states and the District of Columbia. Most of these areas have had previous experience as nonattainment for earlier versions of the NAAQS. Designation as nonattainment imposes more stringent permitting and pollution control requirement for new and modified stationary sources of emissions as compared with the requirements in areas that are in attainment of the NAAQS, and requires the development of State Implementation Plans demonstrating how emissions will be reduced sufficiently to reach attainment.

EPA estimates the cost of meeting the 70 ppb standard in all states except California at \$1.4 billion annually in 2025. Because most California areas would have until the 2030s to reach attainment, EPA provided separate cost estimates for California (\$0.80 billion annually, post-2025). These cost estimates are substantially less than those from the National Association of Manufacturers and other industry sources, which have been widely cited. The benefits of reducing ozone concentrations were estimated by EPA at \$2.9-\$5.9 billion annually by 2025. The dollar value of avoided premature deaths accounts for 94% to 98% of this estimate.

The agency projects that most areas will be able to reach attainment of the new standards by 2025 as a result of already promulgated regulations for gasoline, autos, power plants, and other emission sources. These regulations are being implemented independently of the 2015 NAAQS revision.

Members of Congress have shown particular interest in whether the expected benefits of the standards justify their projected costs. There is controversy over the methods used to estimate both costs and benefits. As the Clean Air Act is currently written, however, the agency is prohibited from weighing costs against benefits in setting NAAQS standards. The statute simply directs EPA to set the primary standard at a level requisite to protect public health, allowing an adequate margin of safety.

Various interest groups have lobbied against strengthening the standards. In the 115th Congress, the House has passed H.R. 806 to delay implementation of the 2015 NAAQS until the mid-2020s and to make changes to the process of future NAAQS revisions. The House Appropriations Committee reported a similar delay as a rider to EPA's 2018 appropriation (in Section 432 of H.R. 3354), but the final version of the appropriation (in H.R. 1625/P.L. 115-141) did not include the rider.

Contents

Introduction	1
What Are NAAQS?	4
Reviewing the Ozone NAAQS.....	6
The NAAQS Review Process	6
Recent Reviews of the Ozone Standard	8
The Primary Standard	8
The Secondary Standard	10
Implementation of the 2015 Standards.....	12
Controlling Ozone Pollution.....	18
Wintertime Ozone.....	18
Costs and Benefits of Control.....	19
EPA's Cost Estimates	19
EPA's Benefit Estimates	21
California and Other Regional Costs and Benefits	22
Industry Estimates	23
Issues	25
The Role of Cost	25
Background Ozone Levels	26
Schedule for Review	28
Monitoring	28
The Role of Federal Versus State and Local Pollution Control Measures	29
Congressional Reaction.....	30

Figures

Figure 1. Ozone Nonattainment Areas (2008 Standard, 0.075 ppm) as of June 2018.....	3
Figure 2. Nonattainment Areas for 2015 Ozone NAAQS (0.070 ppm)	13
Figure 3. EPA Projection of Counties That Will Not Meet the Revised Ozone Standards in 2025 Without Promulgation of Additional Emission Controls.....	21

Tables

Table 1. History of the National Ambient Air Quality Standards for Ozone.....	7
Table 2. List of Nonattainment Areas for 2015 Ozone NAAQS	15
Table 3. Estimated Annual Costs and Health Benefits of Ozone NAAQS Options, Nationwide Except California, in 2025	19
Table 4. Estimated Annual Costs and Health Benefits of Ozone NAAQS Options in California, Post-2025	23

Contacts

Author Contact Information	32
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Introduction

On October 1, 2015, under the authority of Sections 108 and 109 of the Clean Air Act (CAA) as amended,¹ the Environmental Protection Agency (EPA) finalized revisions² to the National Ambient Air Quality Standards (NAAQS) for ground-level ozone³ from the then-current level of 75 parts per billion (ppb) to 70 ppb.

As described in detail below (see “Implementation of the 2015 Standards”), under the CAA, revision of the standards sets in motion a process in which states and EPA identify areas that do not meet the standards (“nonattainment areas”) and the states prepare implementation plans to demonstrate how emissions will be lowered sufficiently to reach attainment in those areas.

The revised standards are based on a review of more than 1,000 scientific studies by EPA staff.⁴ The EPA science assessment was itself reviewed by a panel of 20 outside scientific experts, a group known as the Clean Air Scientific Advisory Committee (CASAC).⁵ The EPA Administrator was under a court order to sign any changes or reaffirm the standards by October 1, 2015. A comment period, public hearings, and interagency review had followed the publication of a proposed range of standards in December 2014.

Ground-level ozone (often referred to as “smog”) is associated with potentially serious health effects when present in high enough concentrations. These health effects include aggravated asthma, chronic bronchitis, and heart attacks, and in some cases premature death. In the Regulatory Impact Analysis (RIA) accompanying the 2015 rule, EPA stated that reducing concentrations to 70 ppb versus the previous standard of 75 ppb⁶ would avoid 320 to 660 premature deaths annually in 2025 nationwide (excluding California).⁷ California was excluded from EPA’s estimate of both costs and benefits of the nationwide standard, because most areas of the state will have until the 2030s to reach attainment of the NAAQS.⁸ California costs and benefits are presented separately in the “Costs and Benefits of Control” section of this report.

¹ The Clean Air Act, codified as 42 U.S.C. 7401 *et seq.*

² EPA, “National Ambient Air Quality Standards for Ozone: Final Rule,” October 1, 2015, <http://www3.epa.gov/ozonepollution/actions.html>. The rule appeared in the Federal Register October 26, 2015, at 80 *Federal Register* 65292.

³ Ground-level (tropospheric) ozone can be a lung irritant with serious adverse health effects. In the stratosphere, however, ozone protects the Earth from harmful ultraviolet rays of the sun. For more information, see EPA, “Ozone—Good Up High Bad Nearby,” at <https://cfpub.epa.gov/airnow/index.cfm?action=gooduphigh.index>.

⁴ See EPA, “Final Report: Integrated Science Assessment of Ozone and Related Photochemical Oxidants,” U.S. EPA, Washington, DC, EPA/600/R-10/076F, 2013, <http://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=247492>.

⁵ CASAC’s review of the ISA, dated November 14, 2012, can be found at [http://yosemite.epa.gov/sab/sabproduct.nsf/60C2732674A5EEF385257AB6007274B9/\\$File/EPA-CASAC-13-001+unsigned.pdf](http://yosemite.epa.gov/sab/sabproduct.nsf/60C2732674A5EEF385257AB6007274B9/$File/EPA-CASAC-13-001+unsigned.pdf).

⁶ The ozone NAAQS is also frequently expressed in terms of parts per *million* rather than parts per *billion*. A standard of 0.075 parts per million (ppm) would be the same as a standard of 75 parts per billion (ppb), and is often referred to as such. This report uses parts per billion in most cases, as does EPA in most of the explanatory materials accompanying the standard. Until 2008, the standard was expressed in parts per million with two decimal places (e.g., 0.08 ppm from 1997 to 2008). Without a third decimal place, concentrations as high as 0.084 ppm (or 84 ppb) could be rounded to 0.08 and considered to be in attainment of the standard. The 2008 standard added greater precision to the standard by adding a third decimal place (0.075 ppm).

⁷ EPA, *Regulatory Impact Analysis of the Final Revisions to the National Ambient Air Quality Standards for Ground-Level Ozone*, September 2015, pp. ES-14 to ES-19, at <https://www3.epa.gov/ttn/naaqs/standards/ozone/data/20151001ria.pdf>. Hereinafter, “EPA, 2015 RIA.” A separate estimate for California shows a 70 ppb NAAQS resulting in 120-220 premature deaths avoided annually post-2025 (p. ES-18).

⁸ Most of California’s population lives in areas classified as Severe or Extreme for their nonattainment, under the Clean Air Act’s statutory categorization scheme. These areas have more stringent emission control requirements and more

High ozone concentrations also affect the growth of plants, causing damage to both forests and field crops. In 2006, the U.S. Forest Service examined 380 monitoring sites in the Mid-Atlantic and Southeastern states and found visible injury to forest plants from ozone at 121 (32%) of them. At 20 of the sites, the damage was described as “severe.”⁹ In addition, EPA found that “several economically important crop species are sensitive to ozone levels typical of those found in the United States,” and estimated that crop losses could be reduced by \$400 million to \$620 million annually by implementation of a more stringent ozone standard.¹⁰

While EPA’s analysis has found that there would be substantial health and welfare benefits to reducing ozone, the agency also has concluded that there could be substantial costs. In the RIA, EPA estimated the economic value of the benefits of reducing ozone concentrations to 70 ppb (for areas other than California) at \$2.9-\$5.9 billion annually by 2025, with costs at \$1.4 billion annually in 2025.¹¹

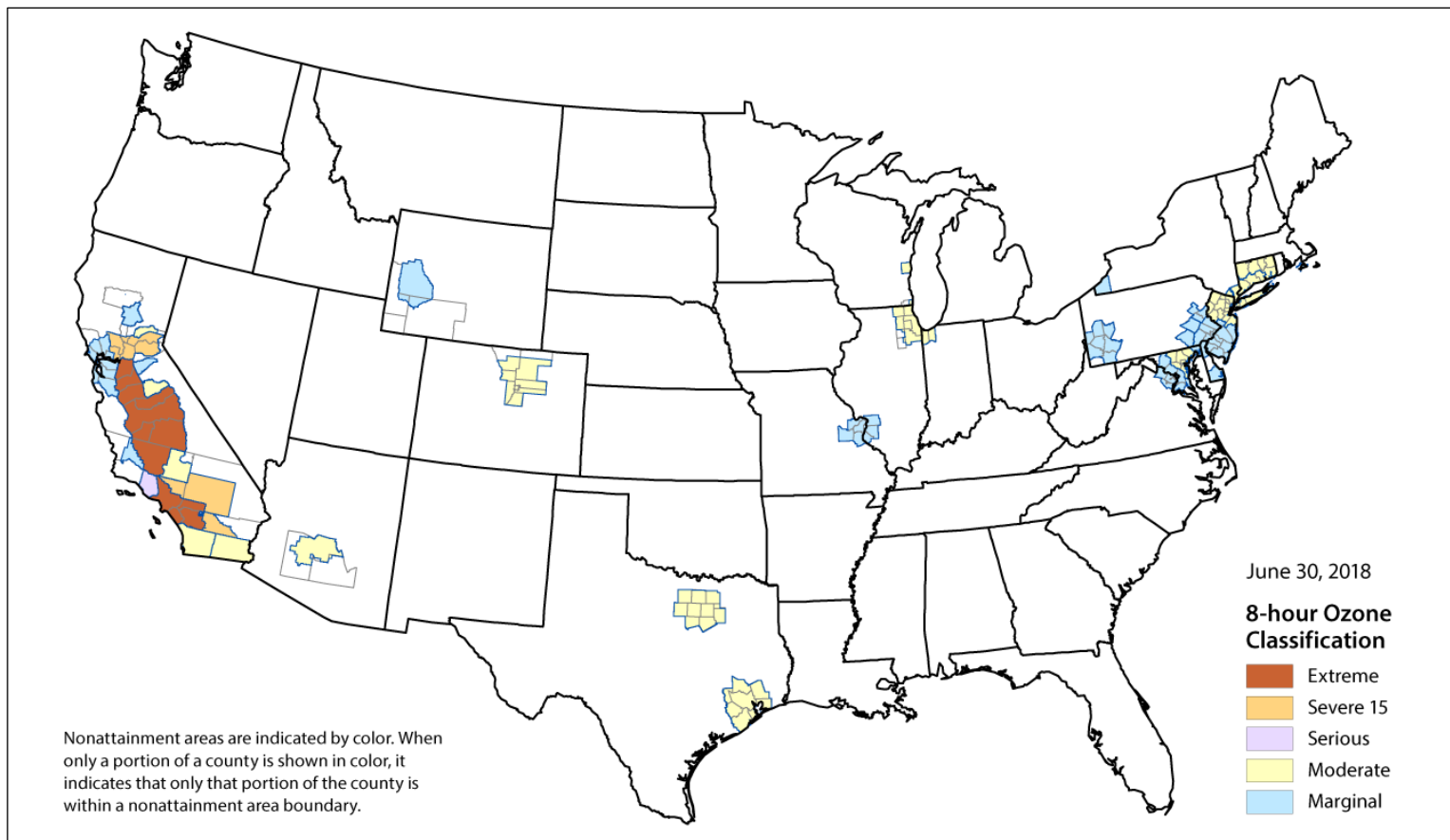
time to reach attainment, so EPA provided separate cost-benefit estimates for the state.

⁹ EPA, *Regulatory Impact Analysis, Final National Ambient Air Quality Standard for Ozone*, July 2011, p. 64, at <https://www.nrc.gov/docs/ML1224/ML12240A237.pdf>.

¹⁰ *Ibid.*, p. 74.

¹¹ EPA, 2015 RIA, p. ES-15. Most of California’s population lives in areas classified as Severe or Extreme for their nonattainment, under the Clean Air Act’s statutory categorization scheme. These areas have more stringent emission control requirements and more time to reach attainment, so EPA provided separate cost-benefit estimates for the state.

Figure I. Ozone Nonattainment Areas (2008 Standard, 0.075 ppm) as of June 2018



Source: U.S. EPA Green Book, https://www3.epa.gov/airquality/greenbook/map/map8hr_2008.pdf. Map shows areas designated nonattainment with respect to the 2008 ozone standard by EPA as of June 30, 2018.

Notes: Nonattainment designations were based on 2008-2010 monitoring data in most cases. Eighteen of the 38 areas shown now have monitoring data indicating attainment of the standard, but, as of June 2018, had not completed administrative requirements to be reclassified to “attainment.”

The ozone NAAQS are among EPA's most far-reaching standards. At the level set in March 2008 (75 ppb), 107 million people lived in areas that were designated nonattainment for the standards (see **Figure 1**), as of June 2018.¹² These 38 areas (referred to as "nonattainment areas") include 168 counties in 17 states and the District of Columbia.¹³ The areas generally coincide with metropolitan areas, but may be larger or smaller. Of the 38 areas, 18 have ozone readings that indicate they have attained the standard, which would leave 20 areas with a combined population of nearly 78 million not attaining the standard.¹⁴

When it promulgated the 2015 NAAQS revision, EPA stated that if the most recent monitoring data then available (for the years 2012-2014) were used to identify nonattainment areas for the revised standards, the number of counties showing nonattainment would be 241 in 33 states and the District of Columbia.¹⁵ The actual nonattainment designations promulgated in 2018 are in most cases based on 2014-2016 monitoring data and include just over 200 counties or partial counties in 22 states and the District of Columbia, plus two tribal areas. (See **Figure 2**.) In the intervening years, the emissions that contribute to ozone formation have declined, in response to already promulgated standards for motor vehicles, gasoline, power plants, and other sources of emissions. Thus, the number of counties showing nonattainment is lower than the EPA estimate released in 2015.¹⁶

The potential economic, health, and environmental impacts of a change in the ozone NAAQS have led to great interest in EPA's review and implementation of the standards. To assist Members and staff in evaluating the process and its potential impacts, this report provides background on NAAQS, the process used to establish them, the 2008 and 2015 ozone standards, and issues that have been raised as EPA implements the final rule.

What Are NAAQS?

NAAQS are federal standards that apply to ambient (outdoor) air. Section 109 of the Clean Air Act directs EPA to set both primary NAAQS, which are standards, "the attainment and maintenance of which in the judgment of the [EPA] Administrator ... are requisite to protect the public health," with "an adequate margin of safety," and secondary NAAQS, which are standards

¹² For specifics, see EPA's "Green Book," at <https://www.epa.gov/green-book>.

¹³ EPA, *Green Book 8-Hour Ozone (2008) Area Information*, Designated Area/State Information, June 30, 2018, <https://www3.epa.gov/airquality/greenbook/hbtc.html>.

¹⁴ EPA may issue a determination of attainment, sometimes referred to as a "Clean Data Determination," after notice and comment rulemaking determining that a specific area is attaining the relevant standard. This is not the same as redesignation to attainment, however. EPA does not formally redesignate areas as attainment until the state meets statutory criteria, including submission of a certified monitoring data and obtaining EPA approval for a Maintenance Plan. The Maintenance Plan shows how the nonattainment area will maintain compliance with the NAAQS for a 10-year period. For additional discussion see EPA, "Determinations of Attainment by the Attainment Date, Extensions of the Attainment Date, and Reclassification of Several Areas for the 2008 Ozone National Ambient Air Quality Standards," 86 *Federal Register* 26697, 26701, May 4, 2016. For list of areas with Clean Data Determinations/Attainment Determinations that are designated as nonattainment with respect to the 2008 ozone standard (as of June 30, 2008), see EPA Green Book, <https://www3.epa.gov/airquality/greenbook/hfr2rpt5.html>.

¹⁵ See EPA, "County-level Design Values for the 2015 Ozone Standards," at <https://www.epa.gov/ozone-pollution/ozone-data-tables-1997-2008-and-2015-standards>.

¹⁶ When the agency promulgated a revision to the ozone NAAQS in March 2008, it identified 345 counties with monitors showing nonattainment of the new standard. By the time the agency designated nonattainment areas in May 2012, the number of nonattaining counties had declined to 232.

necessary to protect public welfare, a broad term that includes damage to crops, vegetation, property, building materials, climate, etc.¹⁷

The pollutants for which NAAQS have been set are generally referred to as “criteria” pollutants. The act defines them as pollutants that “endanger public health or welfare,” and whose presence in ambient air “results from numerous or diverse mobile or stationary sources.”¹⁸ Six pollutants (or categories of pollutants) are currently identified as criteria pollutants: ozone, particulates, carbon monoxide, sulfur dioxide, nitrogen oxides, and lead. The EPA Administrator can add to this list if he determines that additional pollutants meet the definition, or delete pollutants from the list if they no longer meet the definition. There have been no changes to the list, however, since the late 1970s.

NAAQS are at the core of the Clean Air Act even though they do not directly regulate emissions. In essence, they are standards that define what EPA considers to be clean air for the pollutant in question. Once a NAAQS has been set, the agency, using monitoring data and other information submitted by the states, identifies areas that exceed the standards and must reduce pollutant concentrations; these areas are referred to as “nonattainment areas.” The designation process is often delayed by litigation over the standards, by EPA’s agreement to reconsider aspects of them, or by consultations with the states regarding the specifics of the areas to be designated. Designation of nonattainment areas for the 1997 ozone NAAQS, for example, took seven years. Designations under the 2008 standards took four years.

After nonattainment areas are designated, state and local governments have up to three years to produce State Implementation Plans (SIPs), which outline the measures that will reduce emission levels and attain the standards. Finalizing SIPs, through EPA review and approval, often takes longer.

Under the CAA, actual attainment of the ozone NAAQS is allowed to stretch over a three-year to 20-year period, depending on the severity of the area’s pollution. Ozone nonattainment areas are designated as Marginal, Moderate, Serious, Severe, or Extreme, depending on the level of pollution. Each of these classifications comes with required pollution control measures: the more severe the pollution, the more stringent are the required controls, and the longer the area is allowed before it must demonstrate attainment.¹⁹

Thus, establishment or revision of a NAAQS is not an event that requires immediate compliance with an air quality standard; rather, it sets in motion a long and complex implementation process. That process may ultimately have far-reaching impacts for public health and welfare, for sources of pollution in numerous economic sectors, and for states and local governments.

EPA has several tools available to encourage nonattainment areas to comply with a NAAQS. The most frequently mentioned of these is the potential for highway-fund sanctions: failure to submit or implement a SIP adequate to attain or maintain compliance with the NAAQS can lead to the temporary suspension of federal highway funds for new nonsafety-related projects. Ultimately, EPA can impose a federal implementation or maintenance plan (a FIP) in an area that does not

¹⁷ The CAA’s definition of welfare is found in Section 302(h) of the act (42 U.S.C. 7602(h)).

¹⁸ Authority to establish NAAQS comes from both Sections 108 and 109 of the act; this definition of criteria pollutants is found in Section 108. The authority and procedures for controlling the sources of criteria pollutants are found throughout Titles I, II, and IV of the act. Many pollutants that are less widely emitted are classified as “hazardous air pollutants” and are regulated under a different section of the act (Section 112). That section lists 187 pollutants or groups of pollutants as hazardous and establishes different authorities and requirements for controlling their emissions.

¹⁹ For a more detailed discussion, see CRS Report RL30853, *Clean Air Act: A Summary of the Act and Its Major Requirements*.

have an approved SIP. Imposition of sanctions or FIPs is relatively rare, however: generally the states avoid sanctions by submitting plans that require sufficient emission reductions to be deemed adequate by EPA.²⁰

In addition to state and local actions to address ambient concentrations of NAAQS pollutants, EPA itself acts to control emissions and concentrations of criteria pollutants through national standards. These national standards apply to products that contribute to ozone and other criteria pollution (particularly mobile sources, such as automobiles) and to stationary emission sources (such as power plants). These standards lead to emission reductions that states can factor into their implementation plans, reducing the need for local air pollution control measures.

Reviewing the Ozone NAAQS

Section 109(d) of the Clean Air Act requires the agency to review each NAAQS every five years. That schedule is rarely met, but it often triggers lawsuits that force the agency to undertake or complete a review.²¹ In June 2013, the Sierra Club and three other groups filed suit over EPA's failure to complete the required review of the 2008 ozone NAAQS by the March 2013 deadline, and a court subsequently ordered EPA to propose any changes to the standards by December 1, 2014, and complete the review, with promulgation of any revisions by October 1, 2015.²²

A historical review of the ozone NAAQS and their revisions is presented in **Table 1**.

The NAAQS Review Process

Reviewing an existing NAAQS is generally a long process. To begin the process, EPA scientists compile the scientific literature published since the last NAAQS revision, and summarize it in a report known as a Criteria Document or Integrated Science Assessment (ISA). The ISA for ozone, completed in February 2013, reviewed more than 1,000 scientific studies.²³

Ozone ISAs cover topics as wide-ranging as the physics and chemistry of ozone in the atmosphere; environmental concentrations, patterns, and exposure; dosimetry; animal-to-human extrapolation; toxicology; interactions with co-occurring pollutants; controlled human exposure studies; epidemiology; effects on vegetation and ecosystems; effects on UVB (ultraviolet light) exposures and climate; and effects on man-made materials.

Following completion of the ISA, EPA prepares a Risk and Exposure Assessment to identify exposure pathways, at-risk populations, and health endpoints. This document was completed for the 2015 review in August 2014.²⁴

²⁰ See CRS Report R44050, *Transportation Conformity Under the Clean Air Act*.

²¹ CRS Report R41563, *Clean Air Issues in the 112th Congress*, summarizes EPA's recent efforts to review the NAAQS and implement revisions, including the next steps as of 2012 for each of the six criteria pollutants. Reviews of all six pollutants (ozone, PM, lead, NO₂, CO, and SO₂) have been completed since 2006, with the standards being made more stringent for five of the six.

²² *Sierra Club v. EPA*, No. 13-2809 (N.D. Cal., Apr. 30, 2014) (unpublished).

²³ EPA, Office of Research and Development, *Integrated Science Assessment of Ozone and Related Photochemical Oxidants*, Final Report, February 2013, at <http://www.epa.gov/ncea/isa/ozone.htm>. For access to references cited in the first, second, and third external review draft and final ozone ISAs, see EPA's "Health and Environmental Research Online" page at http://hero.epa.gov/index.cfm/project/page/project_id/1628.

²⁴ EPA, *Ozone (O₃) Standards - Documents from Current Review - Risk and Exposure Assessments*, at <https://www.epa.gov/naaqs/ozone-o3-standards-risk-and-exposure-assessments-current-review>.

Table I. History of the National Ambient Air Quality Standards for Ozone
(1971-2015)

Year	Final Rule/Decision	Primary/Secondary	Indicator	Averaging Time	Level	Form
1971	36 FR 8186 Apr 30, 1971	Primary and Secondary	Total photochemical oxidants	1-hour	0.08 ppm	Not to be exceeded more than one hour per year.
1979	44 FR 8202 Feb 8, 1979	Primary and Secondary	Ozone	1-hour	0.12 ppm	Attainment is reached when the number of days per calendar year, with maximum hourly average concentration greater than 0.12 ppm, is equal to or less than one.
1993	58 FR 13008 Mar 9, 1993	EPA decided that revisions to the standards were not warranted at the time.				
1997	62 FR 38856 Jul 18, 1997	Primary and Secondary	Ozone	8-hour	0.08 ppm	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years.
2008	73 FR 16483 Mar 27, 2008	Primary and Secondary	Ozone	8-hour	0.075 ppm	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years.
2015	80 FR 65292 Oct 26, 2015	Primary and Secondary	Ozone	8-hour	0.070 ppm	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years.

Source: EPA, http://epa.gov/ttn/naaqs/standards/ozone/s_o3_history.html.

A final document prepared by EPA staff, the Staff Paper or Policy Assessment, summarizes the information compiled in the ISA and Risk Assessment and provides the Administrator with options regarding the indicators, averaging times, statistical form, and numerical level (concentration) of the NAAQS. A Policy Assessment for the 2015 NAAQS revision was completed and publicly released on August 29, 2014.²⁵

²⁵ EPA, Office of Air and Radiation, *Policy Assessment for the Review of the Ozone National Ambient Air Quality Standards*, August 2014, at <http://www.epa.gov/ttn/naaqs/standards/ozone/data/20140829pa.pdf>. Hereinafter "EPA, 2014 Policy Assessment."

To ensure that NAAQS reviews meet the highest scientific standards, the 1977 amendments to the Clean Air Act required the Administrator to appoint an independent Clean Air Scientific Advisory Committee (CASAC). CASAC has seven members, largely from academia, state air pollution agencies, and private research institutions. In conducting NAAQS reviews, their expertise is supplemented by panels of the nation's leading experts on the health and environmental effects of the specific pollutants that are under review. These panels can be rather large. The panel for the 2015 ozone review, for example, had 20 members. CASAC and the public make suggestions regarding the membership of the panels on specific pollutants, with the final selections made by EPA. The panels evaluate the agency's work during NAAQS-setting and NAAQS-revision, rather than conducting their own independent review of the standards.

Recent Reviews of the Ozone Standard

Before the 2015 review, EPA last changed the NAAQS for ozone in March 2008, from 0.08 ppm (effectively 84 ppb) to 0.075 ppm (75 ppb). Although the standard was strengthened, the level chosen at that time was subject to controversy. A 23-member CASAC Review Panel unanimously recommended a range of standards more stringent than what the Administrator chose.²⁶

In September 2009, EPA agreed to reconsider the 2008 standard. As a result, a more stringent primary standard and a different version of the secondary standard were proposed in January 2010. After a year-and-a-half of public comment and review, EPA sent what it considered a final set of standards to the Office of Management and Budget (OMB) for interagency review. The process was short-circuited, however, by a presidential decision to await conclusion of the next regular review—the review completed in 2015—before promulgating any change.

The Primary Standard

The review completed in 2008 found evidence of health effects, including mortality, at levels of exposure below the then-current 0.08 ppm standard. As a result, both EPA staff and CASAC recommended strengthening the standard. CASAC stated, "There is no scientific justification for retaining the current [0.08 ppm] primary 8-hr NAAQS."²⁷ The panel unanimously recommended a range of 0.060 to 0.070 ppm (60 to 70 parts per billion) for the primary (health-based) 8-hour standard.

²⁶ In a letter to the Administrator sent after promulgation of the NAAQS, the panel's chair stated the following:

Nevertheless, the members of the CASAC Ozone Review Panel do not endorse the new primary ozone standard as being sufficiently protective of public health. The CASAC—as the Agency's statutorily-established science advisory committee for advising you on the national ambient air quality standards—unanimously recommended decreasing the primary standard to within the range of 0.060–0.070 ppm. It is the Committee's consensus scientific opinion that your decision to set the primary ozone standard above this range fails to satisfy the explicit stipulations of the Clean Air Act that you ensure an adequate margin of safety for all individuals, including sensitive populations.

Letter of Rogene F. Henderson, Chair, Clean Air Scientific Advisory Committee, to EPA Administrator Stephen L. Johnson, April 7, 2008, at [http://yosemite.epa.gov/sab/sabproduct.nsf/4AF8764324331288852574250069E494/\\$File/EPA-CASAC-08-009-unsigned.pdf](http://yosemite.epa.gov/sab/sabproduct.nsf/4AF8764324331288852574250069E494/$File/EPA-CASAC-08-009-unsigned.pdf).

²⁷ Letter of Rogene Henderson, Chair, Clean Air Scientific Advisory Committee, to Hon. Stephen L. Johnson, EPA Administrator, October 24, 2006, available at [http://yosemite.epa.gov/sab/sabproduct.nsf/AB290E0DB8B72A33852572120055858F/\\$File/casac-07-001.pdf](http://yosemite.epa.gov/sab/sabproduct.nsf/AB290E0DB8B72A33852572120055858F/$File/casac-07-001.pdf).

EPA staff also recommended strengthening the primary standard. They recommended “considering a standard level within the range of somewhat below 0.080 parts per million (ppm) to 0.060 ppm.”²⁸

Based on these recommendations, and his own judgment regarding the strength of the science, Stephen Johnson, the Bush Administration’s last EPA Administrator, chose to finalize the standard at 0.075 ppm (75 parts per billion).²⁹ That revision led to designation of nonattainment areas in April and May 2012, as shown above in **Figure 1**.³⁰

The Regulatory Impact Analysis that accompanied the final 2008 standard identified 345 counties in 36 states and the District of Columbia in exceedance of the 0.075 ppm standard, using data for 2004-2006 (the most recent available at the time). By May 2012, when the nonattainment areas were actually designated, the number of counties in nonattainment had fallen to 232 in 26 states and the District of Columbia, based mostly on data for 2008-2010.³¹ In the intervening years, emissions declined in most areas as more stringent standards for both mobile and stationary sources took effect. The 2008-2009 recession and other economic factors also contributed to the lower numbers. When the economy is operating well below capacity, emissions generally decline; and changes in the economy (e.g., fewer vehicle miles traveled and a switch to cleaner fuels) have also resulted in lower emissions. As of April 2016, only 115 counties in 12 states exceeded the 2008 ozone NAAQS, although about double that number remained classified as nonattainment pending completion of administrative requirements.

As noted, EPA began a process to reconsider the 2008 ozone NAAQS in September 2009, and proposed a more stringent primary NAAQS in January 2010. The reconsideration process, which generally relied on the same data as that used to set the 2008 standard, led EPA to recommend a primary NAAQS of 0.070 ppm (70 ppb), within the range recommended by the CASAC Ozone Review Panel in 2008. A draft final standard was prepared and sent to OMB for final interagency review in the summer of 2011, but was withdrawn at the President’s request in September 2011.

The 2015 Review

The 2015 review, after assessing more than 1,000 new studies, reached conclusions similar to those of the 2008 process:

The available scientific evidence and exposure/risk information provide strong support for considering a primary O₃ [ozone] standard with a revised level in order to increase public health protection, including for at-risk populations and lifestages. Staff concludes that it is appropriate in this review to consider a revised primary O₃ standard level within the range of 70 ppb to 60 ppb. A standard set within this range would result in important improvements in public protection, compared to the current [2008] standard, and could

²⁸ “Review of National Ambient Air Quality Standards for Ozone Final Staff Paper, Human Exposure and Risk Assessments and Environmental Report,” Fact Sheet, at http://www.epa.gov/ttn/naaqs/standards/ozone/data/2007_01_finalsp_factsheet.pdf.

²⁹ All of EPA’s references to the 2008 standard are expressed as parts per million (e.g., 0.075 ppm), but many references in the press convert this to a more readable parts per billion (i.e., 75 parts per billion).

³⁰ Detailed information on the designations, including links to *Federal Register* notices, can be found on EPA’s website at <https://www.epa.gov/green-book>.

³¹ EPA, “Nonattainment Designations for the 2008 Ozone Standards—Counties by State, April 30, 2012 and May 31, 2012,” at <https://archive.epa.gov/ozonedesignations/web/html/finaldes.html>. A few states had certified monitoring data for 2009-2011, and their designations were based on that three-year period. As of October 2015, the number is 224 counties in 25 states and the District of Columbia. For a listing, see U.S. EPA Green Book, “8-Hr Ozone (2008) Nonattainment Areas,” at <https://www.epa.gov/green-book>.

reasonably be judged to provide an appropriate degree of public health protection, including for at-risk populations and lifestages. In its advice to the Administrator, CASAC also concluded that the scientific evidence and exposure/risk information support consideration of standard levels from 70 to 60 ppb. Within this range, CASAC concluded that a level of 70 ppb would provide little margin of safety and, therefore, provided the policy advice that the level of the O₃ standard should be set below 70 ppb.³²

Based on these recommendations, the EPA Administrator proposed revising the primary NAAQS on November 26, 2014, to a level somewhere in the range of 65 to 70 ppb. She also asked for comments on retaining the 2008 75 ppb standard or promulgating a standard of 60 ppb. In October 2015, she completed the review process, setting the primary ozone NAAQS at 70 ppb.

The Secondary Standard

As part of the review completed in 2008, the 2009-2011 reconsideration process, and the review completed in 2015, EPA also assessed the secondary NAAQS for ozone. As explained above, secondary NAAQS are standards necessary to protect public welfare, a broad term that includes damage to crops, vegetation, property, building materials, climate, etc.³³ Prior to 2008, the secondary standard was identical to the primary standard—0.08 ppm beginning in 1997.

Ozone affects both tree growth and crop yields, and the damage from exposure is cumulative over the growing season. In order to address this damage, EPA staff recommended in the 2008 review that the Administrator establish a new form for the secondary standard: a seasonal (three-month) average that would cumulate hourly ozone exposures for the daily 12-hour daylight window (termed a “W126 index”).³⁴ The staff initially recommended a standard in a range of 7-21 parts per million-hours (ppm-hours). CASAC’s ozone panel agreed unanimously that the form of the secondary standard should be changed as the staff suggested, but it did not agree that the upper bound of the range should be as high as 21 ppm-hours, suggesting that the upper bound be no higher than 15 ppm-hours.³⁵

The Administrator’s June 2007 proposal was in line with the staff recommendation, 7-21 ppm-hours, but his final March 2008 choice was to duplicate the primary standard he promulgated at that time. He set a secondary standard at 0.075 ppm averaged over 8 hours, rejecting the advice of both CASAC and his staff.

The secondary standard carries no deadline for attainment and has never been the subject of penalties or sanctions for areas that failed to meet it, but there was substantial disagreement between the Bush Administration EPA and the Office of Management and Budget over the form in which this standard should be set. OMB maintained that EPA had failed to consider or evaluate the effects of a W126 standard on “economic values, personal comfort, and well-being”—terms that are also included in the Clean Air Act’s definition of welfare—and thus did not provide a balanced consideration of welfare effects, as required by the act. OMB also maintained that EPA

³² EPA, 2014 Policy Assessment, p. ES-5.

³³ The Clean Air Act’s definition of welfare is found in Section 302(h) of the act (42 U.S.C. 7602(h)).

³⁴ The index gives greater weight to higher concentrations of ozone. For a detailed explanation of how it is calculated, see EPA, “Ozone W126 Index,” at <https://www.epa.gov/air-quality-analysis/ozone-w126-index>.

³⁵ Letter of Rogene Henderson, Chair, Clean Air Scientific Advisory Committee, to Hon. Stephen L. Johnson, EPA Administrator, March 26, 2007, p. 3, available at [http://yosemite.epa.gov/sab/sabproduct.nsf/FE915E916333D776852572AC007397B5/\\$File/casac-07-002.pdf](http://yosemite.epa.gov/sab/sabproduct.nsf/FE915E916333D776852572AC007397B5/$File/casac-07-002.pdf).

had not adequately demonstrated that the proposed secondary standard would be more protective than one set equal to the primary standard.³⁶ Ultimately, OMB prevailed.³⁷

Upon reconsideration, the 2011 draft final standards would also have adopted the W126 index and would have set the secondary standard at 13 ppm-hours, in line with CASAC's recommendations. With the President's request to withdraw the draft standard and await completion of the ongoing five-year review, a seasonal standard was not implemented.

EPA's August 2014 Policy Assessment renewed this debate, this time with an additional thumb on the scale. The agency's staff again recommended that the Administrator set a secondary standard using the W126 index. The staff recommended a standard somewhere in the range of 7 to 17 ppm-hours, similar to CASAC's recommended range of 7 to 15 ppm-hours.³⁸ In the interim, the D.C. Circuit Court of Appeals also weighed in. In a July 23, 2013, decision, *Mississippi v. EPA*, the court remanded the 2008 secondary standard to EPA for further explanation or reconsideration: the court found that "EPA must expressly 'determine what level of ... protection is requisite to protect the public welfare,' [citation omitted] and explain why this is so."³⁹

The 2015 final rule is something of a hybrid: it describes the protection offered by the revised secondary standard in terms of a cumulative seasonal approach, but retains the practice of making the standard identical to the primary standard. The overview of the agency's rule states the following:

EPA also is strengthening the secondary standard to improve protection for trees, plants and ecosystems. Like the primary, an area will meet the standard if the fourth-highest maximum daily 8-hour ozone concentration per year, averaged over three years, is equal to or less than 70 ppb. [...]

The agency has assessed ozone exposure to vegetation using a seasonal index known as a "W126 index." A W126 index, named after portions of the equation used to calculate it, is a weighted index designed to reflect the cumulative exposures that can damage plants and trees during the consecutive three months in the growing season when daytime ozone concentrations are the highest and plant growth is most affected.

EPA determined that a W126 index level of 17 parts per million-hours (ppm-hours) is sufficient to protect the public welfare based on the latest science.

Analyses of data from air quality monitors show that an 8-hour standard of 70 ppb will limit cumulative, seasonal exposures above a W126 index level of 17 ppm-hours, averaged over three years.⁴⁰

Whether this explanation is sufficient to address the D.C. Circuit decision in the *Mississippi* case is an open question. CASAC, in its review of the EPA staff recommendations, made two points that might argue against it being sufficient.

³⁶ See "Ozone Secondary Standard," Memorandum of Marcus Peacock, EPA Deputy Administrator, to Susan Dudley, OMB, March 7, 2008, p. 2, at http://www.reginfo.gov/public/postreview/Steve_Johnson_Letter_on_NAAQs_final_3-13-08_2.pdf. For additional discussion, also see CRS Report R41062, *Ozone Air Quality Standards: EPA's Proposed Revisions*.

³⁷ Letter of Susan E. Dudley, Administrator, Office of Information and Regulatory Affairs, OMB, to Stephen L. Johnson, EPA Administrator, March 12, 2008, at http://www.reginfo.gov/public/postreview/Steve_Johnson_Letter_on_NAAQs_final_3-13-08_2.pdf.

³⁸ See EPA, 2014 Policy Assessment, pp. ES-9 to ES-12.

³⁹ *Mississippi v. EPA*, 723 F.3d 246, 272, 273 (D.C. Cir. 2013) (ellipses in original).

⁴⁰ EPA, "Overview of EPA's Updates to the Air Quality Standards for Ground-Level Ozone," October 1, 2015, pp. 4-5, at https://www.epa.gov/sites/production/files/2015-10/documents/overview_of_2015_rule.pdf.

First, they stated the following:

The CASAC does not support a level higher than 15 ppm-hrs. For example, at 17 ppm-hrs, the median tree species has 6% relative biomass loss, and the median crop species has over 5% yield loss. These levels are unacceptably high.... Furthermore, there are specific economically significant crops, such as soybeans, that may not be protected at 15 ppm-hrs but would be protected at lower levels. A level below 10 ppm-hrs is required to reduce foliar injury. A level of 7 ppm-hrs is protective of relative biomass loss for trees and offers additional protection against crop yield loss and foliar injury.⁴¹

Second, CASAC specifically did not recommend a three-year average for the secondary standard, stating that if the agency chose a three-year average, “then the level of the standard should be revised downward such that the level for the highest three-month summation in any given year of the three-year period would not exceed the scientifically recommended range of 7 ppm-hrs to 15 ppm-hrs.”⁴²

Implementation of the 2015 Standards

Promulgation of the NAAQS Revisions in October 2015 set in motion a long implementation process in which EPA works with state, local, and tribal air quality agencies to identify areas that do not meet the revised ozone standards and then implements measures designed to reach attainment.⁴³

A first major step occurred in October 2016, when the states (and six authorized Indian tribes), using monitoring data and other information, submitted to EPA lists showing recommended attainment/nonattainment area designations. As shown in **Table 2**, the states identified 213 counties in 55 potential nonattainment areas. The list included areas in 21 states and the District of Columbia. Indian tribes with designated Clean Air Act authority identified two additional areas as nonattainment.

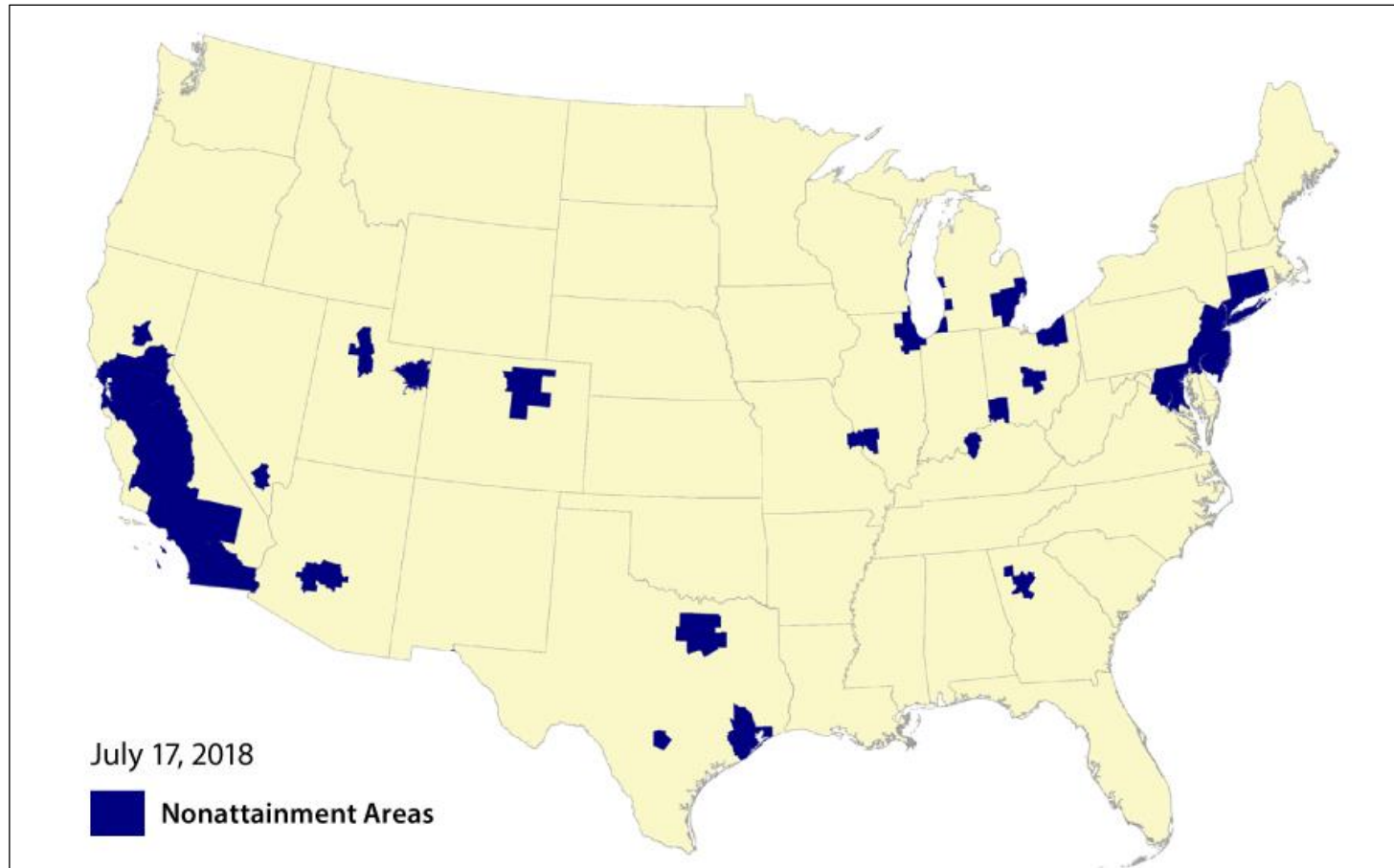
The list contained approximately the same number of states and counties as were designated nonattainment for the previous (2008) ozone NAAQS at the time, and most of the counties identified by the states are currently in nonattainment for the 2008 standard or are covered by a maintenance plan, having attained that or an earlier ozone NAAQS.

⁴¹ Letter of Dr. H. Christopher Frey, Chair, Clean Air Scientific Advisory Committee, to Hon. Gina McCarthy, Administrator, U.S. EPA, June 26, 2014, p. iii, at [http://yosemite.epa.gov/sab/sabproduct.nsf/5EFA320CCAD326E885257D030071531C/\\$File/EPA-CASAC-14-004+unsigned.pdf](http://yosemite.epa.gov/sab/sabproduct.nsf/5EFA320CCAD326E885257D030071531C/$File/EPA-CASAC-14-004+unsigned.pdf).

⁴² *Ibid.*, pp. iii-iv.

⁴³ The implementation process is outlined in “Implementing the 2015 Ozone NAAQS,” Memorandum of Janet G. McCabe, Acting Assistant Administrator, Office of Air and Radiation, EPA, to Regional Administrators, Regions 1-10, October 1, 2015, at https://www.epa.gov/sites/production/files/2015-10/documents/implementation_memo.pdf.

Figure 2. Nonattainment Areas for 2015 Ozone NAAQS (0.070 ppm)
(as of July 17, 2018)



Source: U.S. EPA, Nonattainment Area Designations for the 2015 Ozone Standards, July 17, 2018, available at https://www.epa.gov/sites/production/files/2018-07/documents/ozone_designations_national_map_with_san_antonio_added.pdf.

Notes: Alaska and Hawai'i are not shown: no areas in Alaska and Hawai'i exceeded the 70 ppb standard, based on 2013-2015 monitoring data.

The second step of the implementation process, in which EPA responds to the state and tribal recommendations, is now complete. In this step, EPA reviews the recommendations and finalizes designations after what is often significant dialogue with the states. Negotiations between EPA and the states during the designation process tend to focus on the quality of the monitoring data, whether exceptional events⁴⁴ or other factors outside the state's control affected air quality during the monitoring period, and what the boundaries of identified nonattainment areas should be.⁴⁵ The boundary question may lead to the inclusion of additional counties or partial counties where emissions contribute to nonattainment downwind, even though the county itself has monitored data demonstrating attainment.⁴⁶ The states often provide more recent monitoring data during this process, which may result in an area demonstrating that it has attained the standard or may change the area's classification (e.g., as Marginal or Moderate nonattainment).⁴⁷

This second step resulted in three separate actions designating areas under the 2015 ozone NAAQS

- on November 16, 2017, EPA designated 2,646 counties as in attainment with the 2015 ozone standards;⁴⁸
- on April 30, 2018, the agency identified 51 areas with 159 entire counties and 41 partial counties as nonattainment.⁴⁹ All other areas, with the exception described in the next bullet, were designated attainment/unclassifiable or unclassifiable; and
- on July 17, 2018, the agency made final designation decisions for an eight-county area that includes San Antonio, TX, designating one county as nonattainment and the remaining seven counties as attainment. This action completed the area designations with respect to the 2015 ozone standard.⁵⁰

⁴⁴ EPA regulations can allow the states to exclude monitoring data for periods affected by exceptional events (forest fires, unusual weather conditions, volcanic or seismic activities, etc.) from the data used to make designation decisions. For additional information, see U.S. EPA, "Treatment of Data Influenced by Exceptional Events," at <https://www.epa.gov/air-quality-analysis/treatment-data-influenced-exceptional-events>.

⁴⁵ EPA provided guidance to states and tribes to consider when making their recommendations for initial designations. In particular, EPA recommended states and tribes evaluate five factors: (1) air quality data, (2) emissions and emissions-related data, (3) meteorology, (4) geography/topography, and (5) jurisdictional boundaries. See Janet G. McCabe, Acting Assistant Administrator, Office of Air and Radiation, EPA, "Area Designations for the 2015 Ozone National Ambient Air Quality Standards," Memorandum to Regional Administrators, Regions 1-10, February 26, 2016, at <https://www.epa.gov/sites/production/files/2016-02/documents/ozone-designations-guidance-2015.pdf>.

⁴⁶ For example, EPA disagreed with Nevada's recommended boundary for the portion of Clark County to be designated nonattainment, in part because the state's recommended boundary excluded a monitor showing ozone violations. See EPA, Las Vegas Nonattainment Area, Intended Designations for the 2015 Ozone National Ambient Air Quality Standards, Technical Support Document, December 2017, p. 30, https://www.epa.gov/sites/production/files/2017-12/documents/nv_120d_tsd_combined_final.pdf.

⁴⁷ The 2016 state recommendations were based, in general, on 2013-2015 monitoring data. In 2017, some states submitted 2014-2016 data to EPA for consideration. For example, in April 2017, Pennsylvania submitted 2014-2016 monitoring data to EPA. See Cosmo Servidio, Regional Administrator, EPA Region 3, letter to The Honorable Tom Wolfe, Governor of Pennsylvania, December 20, 2017, <https://www.epa.gov/sites/production/files/2018-01/documents/pa-epa-response-ozone2.pdf>.

⁴⁸ EPA, "Air Quality Designations for the 2015 Ozone National Ambient Air Quality Standards (NAAQS)," 82 *Federal Register* 54232, November 16, 2017.

⁴⁹ EPA, "Additional Air Quality Designations for the 2015 Ozone National Ambient Air Quality Standards," 83 *Federal Register* 25776, June 4, 2018.

⁵⁰ EPA, "Additional Air Quality Designations for the 2015 Ozone National Ambient Air Quality Standards—San Antonio, Texas Area," 83 *Federal Register* 35136, July 25, 2018.

Once EPA designates nonattainment areas, it classifies the areas into categories based on the severity of nonattainment. The classifications are, in increasing order of severity: Marginal, Moderate, Serious, Severe, and Extreme. EPA also sets a schedule for states to submit State Implementation Plans (SIPs), which outline the measures that will reduce emission levels. In a Fact Sheet accompanying the designations, EPA states that “Areas classified as Marginal are not required to submit plans demonstrating how they will meet the ozone standards. For all other nonattainment areas, states have three to four years after the effective date of final designations to develop and submit required SIP elements to EPA.”⁵¹ Finalizing SIPs, through EPA review and approval, often takes longer than the three- to four-year period.

Finally, under the CAA, actual attainment of the standards is allowed to stretch over a three-year to 20-year period, depending on the severity of the area’s pollution.⁵²

Table 2. List of Nonattainment Areas for 2015 Ozone NAAQS

State or Tribe	State and Tribe Recommendations (2016)		EPA Nonattainment Designations (2018)	
	Nonattainment Areas	Counties and Partial Counties in the Identified Areas	Nonattainment Areas	Counties and Partial Counties in the Identified Areas ^a
Alabama	0	0	0 ^b	0 ^b
Alaska	0	0	0	0
Arizona	2	4	2	4
Arkansas	0	0	0 ^b	0 ^b
California	19	37	19	37
Colorado	1	9	1	9
Connecticut	2	8	2	8
Delaware	1	1	1	1
District of Columbia	1	1	1	1
Florida	0	0	0	0
Fond du Lac (MN)	0	0	0	0
Forest County Potawatomi (WI)	0	0	0	0
Georgia	1	8	1	7
Gila River (AZ)	0	0	0	0
Hawai'i	0	0	0 ^b	0 ^b
Idaho	0	0	0 ^b	0 ^b

⁵¹ U.S. Environmental Protection Agency, *Fact Sheet: Final Area Designations for the National Ambient Air Quality Standards for Ozone Established in 2015*, May 2018, p. 1, https://www.epa.gov/sites/production/files/2018-04/documents/placeholder_0.pdf.

⁵² U.S. Environmental Protection Agency, “Implementation of the 2015 National Ambient Air Quality Standards for Ozone: Nonattainment Area Classifications Approach,” 83 *Federal Register* 10380, March 9, 2018.

State or Tribe	State and Tribe Recommendations (2016)		EPA Nonattainment Designations (2018)	
	Nonattainment Areas	Counties and Partial Counties in the Identified Areas	Nonattainment Areas	Counties and Partial Counties in the Identified Areas ^a
Illinois	2	11	2	9
Indiana	0	0	2	3
Iowa	0	0	0 ^b	0 ^b
Kansas	0	0	0 ^b	0 ^b
Kentucky	1	3	2	6
Louisiana	1	5	0	0
Maine	0	0	0 ^b	0 ^b
Maryland	3	12	3	12
Massachusetts	0	0	0	0
Michigan	5	11	4	10
Minnesota	0	0	0 ^b	0 ^b
Mississippi	0	0	0 ^b	0 ^b
Missouri	1	5	1	4
Montana	0	0	0 ^b	0 ^b
Morongo Band (CA)	1	1	1	1
Nebraska	0	0	0 ^b	0 ^b
Nevada	1	1	1	1
New Hampshire	0	0	0 ^b	0 ^b
New Jersey	1	21	2	21
New Mexico	1	1	1	1
New York	1	9	1	9
North Carolina	0	0	0 ^b	0 ^b
North Dakota	0	0	0 ^b	0 ^b
Ohio	3	15	3	15
Oklahoma	0	0	0	0
Oregon	0	0	0	0
Pechanga (CA)	1	2	1	2
Pennsylvania	4	14	1	5
Rhode Island	0	0	0	0
South Carolina	0	0	0 ^b	0 ^b
South Dakota	0	0	0 ^b	0 ^b
Tennessee	0	0	0 ^b	0 ^b

State or Tribe	State and Tribe Recommendations (2016)		EPA Nonattainment Designations (2018)	
	Nonattainment Areas	Counties and Partial Counties in the Identified Areas	Nonattainment Areas	Counties and Partial Counties in the Identified Areas ^a
Texas	4	21	3	16
Utah	3	7	3	7
Ute (UT)	0	0	0	0
Vermont	0	0	0 ^b	0 ^b
Virginia	1	9	1	9
Washington	0	0	0	0
West Virginia	0	0	0	0
Wisconsin	0	0	5	6
Wyoming	0	0	0	0
Total ^c	55	213	52	201 ^c

Source: U.S. EPA, 2015 Ozone Standards—State Recommendations, EPA Responses, and Technical Support Documents and 2015 Ozone Standards—Tribal Recommendations and EPA Responses, accessed April 3, 2018, available at <https://www.epa.gov/ozone-designations/2015-ozone-standards-state-recommendations>. U.S. EPA, Ozone Designations Regulatory Actions, accessed August 8, 2018, available at <https://www.epa.gov/ozone-designations/ozone-designations-regulatory-actions>.

Notes: Most states submitted initial recommendations to EPA on or about October 1, 2016, using monitoring data for 2013-2015 to make their recommendations. In some cases, the submission letter included preliminary information for 2016, through August 31 of the year. EPA notified states that they could submit more recent data (e.g., for years 2015-2017) by February 28, 2018. Final designations were based on 2014-2016 or 2015-2017 data.

- a. The term “county” includes noncounty administrative or statistical areas that are comparable to counties. Louisiana parishes; the organized boroughs of Alaska; the District of Columbia; and the independent cities of the states of Virginia, Maryland, Missouri, and Nevada are equivalent to counties for administrative purposes. Alaska’s Unorganized Borough is divided into 10 census areas that are statistically equivalent to counties. Using this definition, as of 2017, there are 3,142 counties and county-equivalents in the United States.
- b. EPA designated the entire state as attainment/unclassifiable. See EPA, “Air Quality Designations for the 2015 Ozone National Ambient Air Quality Standards (NAAQS),” 82 *Federal Register* 54232, November 16, 2017.
- c. Several areas include counties in more than one state, including areas in Kentucky and Ohio (Cincinnati nonattainment area); Connecticut, New Jersey, and New York (metropolitan New York City nonattainment area); Delaware, Maryland, New Jersey, and Pennsylvania (Philadelphia nonattainment area); Illinois and Missouri (St. Louis nonattainment area); and the District of Columbia, Maryland, and Virginia (Washington, DC, nonattainment area). To avoid double-counting the number of nonattainment areas, the total counts each of these areas only once.
- d. The number of counties includes 160 whole nonattainment counties and county equivalents and 41 partial nonattainment counties. Parts of five counties are included in multiple areas but are only counted once in this total. In addition, EPA designated nonattainment areas in two tribal areas. Source: EPA, *Nonattainment and Unclassifiable Area Designations for the 2015 Ozone Standards—April 30, 2018*, May 2018, p. 5, https://www.epa.gov/sites/production/files/2018-04/documents/placeholder_1.pdf.

Controlling Ozone Pollution

Controlling ozone pollution is more complicated than controlling many other pollutants, because ozone generally is not emitted directly by pollution sources. Rather, it forms in the atmosphere when volatile organic compounds (VOCs) and nitrogen oxides (NO_x) react in the presence of sunlight. The ozone concentration is as dependent on the temperature and amount of sunshine as it is on the presence of the precursor gases. Thus, in general, ozone is a summertime pollutant. Other factors being equal, a cool, cloudy summer will produce fewer high ozone readings than a warm, sunny summer.

There are also complicated reactions that affect ozone formation. In general, lower emissions of precursor gases (particularly lower emissions of VOCs) lead to less ozone. But under some conditions, *higher* emissions of NO_x lead to lower ozone readings. This makes modeling ozone air quality and predicting attainment more difficult and contentious than the modeling of other air pollutants, and can affect consultations between EPA and the states to determine the boundaries of nonattainment areas and the adequacy of SIPs.

Most stationary and mobile sources of air pollution are considered to be contributors to ozone pollution. Thus, there are literally hundreds of millions of sources of the pollutants of concern, and control strategies require implementation of a wide array of measures. Among the sources of VOCs are motor vehicles (about one-fourth of total emissions), industrial processes, particularly the chemical and petroleum industries, and any use of paints, coatings, and solvents (about 40% for these sources combined). Service stations, pesticide application, dry cleaning, fuel combustion, and open burning are other significant sources of VOCs. Nitrogen oxides come overwhelmingly from fuel combustion by motor vehicles, electric utilities, and other industrial sources.

Wintertime Ozone

An emerging set of issues has arisen in regard to wintertime ozone pollution in rural areas of the western United States. Ozone is generally considered a summertime pollutant, but winter exceedances of the ozone NAAQS have recently been found to occur near oil and gas fields in the West.⁵³ At times, ozone concentrations as high as those in Los Angeles, the nation's smoggiest city, have been found in these areas—principally the Upper Green River Basin of Wyoming, the Uintah Basin of Utah, and a nearby area of Colorado.

The mechanism of ozone formation in the areas is still being studied, but recent assessments have found that the thousands of oil and gas wells in the two basins release VOCs that react with NO_x from oil and gas operations and coal-fired power plants to create ozone. A study of the Uintah Basin by the National Oceanic and Atmospheric Administration, EPA, the Bureau of Land Management, the Western Energy Alliance, the Utah Department of Environmental Quality, and seven universities found that sources external to the basin are not major sources of the ozone found within it, and that among inventoried sources within the basin, 98% to 99% of the VOCs and 57% to 61% of the NO_x come from oil and gas operations.⁵⁴ The sunlight necessary for

⁵³ Wintertime ozone levels are occasionally elevated in urban areas, as well, when concentrations of pollution become trapped in cold stagnant air near the Earth's surface. What is unusual about the rural areas discussed in this section of the report is that they do not experience high ozone concentrations in warm weather. In addition, elevated ozone in western rural areas is a newly observed phenomenon, whereas pollution episodes associated with temperature inversions in urban areas have been observed for decades.

⁵⁴ 2012 *Uintah Basin Winter Ozone & Air Quality Study*, Final Report, February 1, 2013, p. 2, at <http://rd.usu.edu/files/>

ozone to be created is magnified when it is reflected off of heavy snow cover. Snow cover also helps create temperature inversions that trap polluted air in the basins. In winters with little snow, there have been few exceedances of the standards.⁵⁵

In 2012, EPA promulgated standards requiring the reduction of VOC emissions from new and modified oil and gas production and transmission operations, including a requirement to use “green completions” on hydraulically fractured onshore natural gas wells. In 2016, these standards were extended to cover hydraulically fractured oil wells. Further, in 2015, EPA proposed Control Techniques Guidelines intended to provide state, local, and tribal air agencies with information to assist them in determining “reasonably available control technology” for reducing VOC emissions from existing oil and natural gas sources in ozone nonattainment areas and states in the Ozone Transport Region.⁵⁶ (For a discussion, see CRS Report R42986, *Methane and Other Air Pollution Issues in Natural Gas Systems*, by Richard K. Lattanzio.) The impact of these regulations on wintertime ozone concentrations is yet to be determined, but interestingly the Upper Green River Basin, which was designated nonattainment under the 2008 ozone NAAQS, has been designated attainment for the 2015 standard.

Costs and Benefits of Control

As noted elsewhere in this report (“The Role of Cost,” below), EPA is prohibited by statute from taking cost into account in setting NAAQS. Despite that prohibition, in order to comply with an executive order (E.O. 12866),⁵⁷ the agency produces a Regulatory Impact Analysis (RIA) analyzing in detail the costs and benefits of new or revised NAAQS standards when the NAAQS are proposed and promulgated.

EPA’s Cost Estimates

Although EPA chose a standard of 70 ppb in the 2015 final rule, the RIA for the rule shows estimates for two options: 70 ppb (the high end of the range for the proposed NAAQS) and 65 ppb (the low end of the range for the proposed NAAQS). EPA’s estimates of the nationwide benefits and costs of the two options for all areas except California are summarized in **Table 3**.

Table 3. Estimated Annual Costs and Health Benefits of Ozone NAAQS Options, Nationwide Except California, in 2025

(in billions of 2011 dollars)

Option	Costs	Health Benefits
70 ppb	\$1.4	\$2.9 to \$5.9
65 ppb	\$16.0	\$15.0 to \$30.0

uploads/ubos_2011-12_final_report.pdf. The remaining NOx comes primarily from the Bonanza Power Plant.

⁵⁵ Ibid. In the Uintah Basin, for example, winter 2011-2012 measurements indicated no exceedance of the 75 ppb NAAQS for ozone: the highest 8-hour average reading was 63 ppb. In 2010-2011, by contrast, there were 25 winter days with ozone levels exceeding the 75 ppb standard, with the highest 8-hour reading being 139 ppb.

⁵⁶ EPA, “Control Techniques Guidelines for the Oil and Natural Gas Industry (Draft),” EPA-453/P-15-001, August 2015, https://www.epa.gov/sites/production/files/2016-09/documents/og_ctg_draft_081815.pdf.

⁵⁷ Executive Office of the President, “Regulatory Planning and Review, Executive Order 12866 of September 30, 1993,” 58 *Federal Register* 51735, October 4, 1993, <http://www.archives.gov/federal-register/executive-orders/pdf/12866.pdf>.

Source: EPA, “Regulatory Impact Analysis” of the Final Revisions to the NAAQS for Ground-Level Ozone, September 2015.

Notes: The data reflect annualized costs and annual monetized benefits of achieving the standard (or a more stringent 65 ppb option considered, but not adopted) in 2025 for all areas of the United States except California. Because of more severe pollution, the Clean Air Act will give most areas of California until the 2030s to reach attainment. The estimates assume a 7% discount rate.

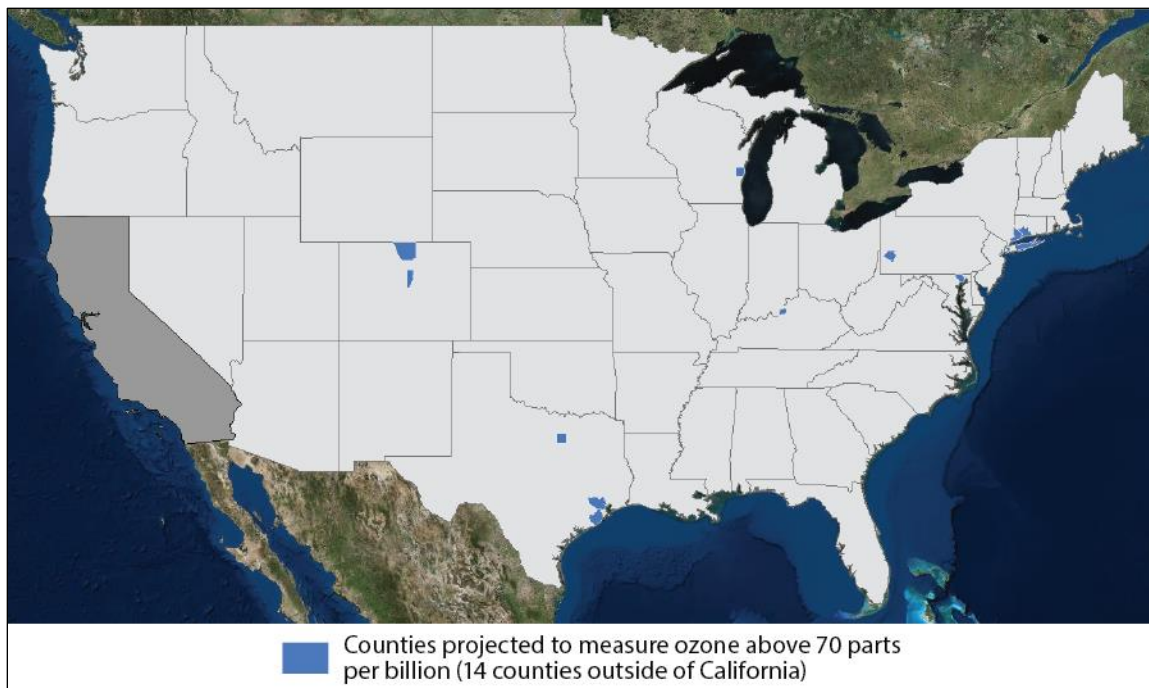
The estimated annual nationwide cost (excluding the cost in California) is \$1.4 billion in 2025 for a 70 ppb standard.⁵⁸ Although this is a large sum, it is substantially less than the cost estimates EPA provided for the same range of standards in 2008 and 2011. At that time, EPA projected costs of \$19 billion to \$25 billion to attain a 70 ppb standard. Two factors account for the reduction in cost:

1. The baseline from which additional costs are projected is now set at 75 ppb (the 2008 standard). In 2011, EPA projected \$7.6 billion to \$8.8 billion in costs to reach what is now that baseline.
2. Other rules promulgated since 2011 (notably the Tier 3 auto emission and gasoline standards and two rules affecting power plants) are expected to reduce ozone precursors whether or not EPA revises the NAAQS. As shown in **Figure 3**, the 2015 RIA projects that, by 2025, these other (already promulgated) rules will bring monitored ozone levels to 70 ppb or below in all but 14 counties (excluding California) of the 241 counties that showed nonattainment with the 70 ppb level, based on 2012-2014 monitoring data.⁵⁹

⁵⁸ EPA, 2015 RIA, p. ES-15.

⁵⁹ For documentation of 241 counties showing nonattainment, see EPA, “County-level Design Values for the 2015 Ozone Standards,” at <https://www.epa.gov/ozone-pollution/ozone-data-tables-1997-2008-and-2015-standards>.

Figure 3. EPA Projection of Counties That Will Not Meet the Revised Ozone Standards in 2025 Without Promulgation of Additional Emission Controls



Source: EPA, “Ozone Maps” accompanying the October 2015 release of the final ozone NAAQS rule, https://ozoneairqualitystandards.epa.gov/OAR_OAQPS/OzoneSliderApp/index.html#.

Notes: EPA did not include areas in California. Because of more severe pollution, the Clean Air Act will give many areas in California until the 2030s to reach attainment. No areas in Alaska and Hawaii are projected to measure ozone above 70 ppb.

EPA’s Benefit Estimates

As presented in its 2015 RIA, EPA’s estimate of monetized nationwide benefits (excluding those in California) ranges from \$2.9 billion to \$5.9 billion annually in 2025 for a 70 ppb standard. The public health benefits of setting a more stringent ozone standard are the monetized value of such effects as fewer premature deaths, fewer hospital admissions, fewer emergency room visits, fewer asthma attacks, less time lost at work and school, and fewer restricted activity days.⁶⁰ The RIA for the final standard states that the nationwide benefits of the revised standard (excluding California) would include the avoidance of 320 to 660 premature deaths annually in 2025 (at 70 ppb) or 1,590 to 3,320 deaths annually (at 65 ppb).⁶¹ The dollar value of the avoided premature deaths accounts for 94% to 98% of EPA’s total monetized benefits.⁶²

⁶⁰ For a full discussion of these variables and their monetized values, see Chapter 6 of the 2008 RIA at http://www.epa.gov/ttn/ecas/regdata/RIAs/452_R_08_003.pdf.

⁶¹ EPA, 2015 RIA, p. ES-16.

⁶² EPA’s estimate uses an approach called the Value of a Statistical Life (VSL). See EPA, 2015 RIA, pp. 6-55. For additional information on VSL, see archived CRS Report R41140, *How Agencies Monetize “Statistical Lives” Expected to Be Saved By Regulations*, by Curtis W. Copeland. (The author of that report is no longer with CRS. Questions on it should be directed to Maeve Carey, Analyst in Government Organization and Management.)

The benefit estimates include benefits of reduced fine particle (PM_{2.5}) concentrations associated with ozone controls, in addition to the benefits of reduced ozone itself. The RIA states that “PM_{2.5} co-benefits account for approximately half to three-quarters of the estimated benefits, depending on the standard analyzed and on the choice of ozone and PM mortality functions used.”⁶³

Including these co-benefits is consistent with the methodology EPA has used in valuing benefits of many other proposed and promulgated standards, but some observers are critical of this approach, noting that including these co-benefits results in a net benefit, whereas an analysis that considered the costs and benefits of ozone reductions in isolation would not.⁶⁴ The control technologies used to capture ozone precursors do capture particles and their precursors, however. Since they do so at no additional cost, EPA has considered this a benefit of the controls.

Other EPA projections of benefits associated with a 70 ppb standard in 2025 include preventing the following, annually:

- 28-260 nonfatal heart attacks,
- 960 hospital admissions and emergency room visits,
- 340 cases of acute bronchitis,
- 11,000 cases of upper and lower respiratory symptoms,
- 230,000 cases of exacerbated asthma,
- 188,000 days when people miss work or school, and
- 620,000 minor restricted activity days.⁶⁵

California and Other Regional Costs and Benefits

EPA provided separate cost and benefit estimates for California. Because of the statutory classification scheme for ozone nonattainment areas, under which more polluted areas have more stringent emission control requirements and more time to reach attainment, most areas of California will have until the 2030s to reach attainment. EPA’s California estimates use projections for post-2025 (see **Table 4**). The agency concluded: “Because of the differences in the timing of achieving needed emissions reductions, incurring costs, and accruing benefits for California, the separate costs and benefits estimates for post-2025 should not be added to the primary estimates for 2025.”⁶⁶

EPA also estimated the costs of the revised NAAQS separately for the eastern United States (defined as Texas and the 36 states to its north and east) and the western United States (Montana, Wyoming, Colorado, New Mexico, and other states to the west, excluding California). These regional estimates show that 98% of the \$1.4 billion estimated cost to achieve a 70 ppb standard is incurred by emission sources in the eastern United States.⁶⁷

⁶³ EPA, 2015 RIA, pp. 8-11.

⁶⁴ In 2017, EPA sought comment on an alternative way to account for human health co-benefits in its benefit-cost analysis of the proposal to repeal the Clean Power Plan. EPA’s 2017 analysis reduced some estimates of the human health co-benefits by assuming no health benefits below specified thresholds for some air pollutants. EPA has not yet finalized the proposed repeal of the Clean Power Plan, nor is it clear whether and how the agency will apply this approach in other regulatory analyses. For more discussion about the treatment of human health co-benefits in the proposed repeal of the Clean Power Plan, see CRS Report R45119, *EPA’s Proposal to Repeal the Clean Power Plan: Benefits and Costs*, by Kate C. Shouse.

⁶⁵ EPA, 2015 RIA, p. ES-16.

⁶⁶ EPA, 2015 RIA, p. ES-17.

⁶⁷ EPA, 2015 RIA, p. ES-17.

Table 4. Estimated Annual Costs and Health Benefits of Ozone NAAQS Options in California, Post-2025

(in billions of 2011 dollars)

Option	Costs	Health Benefits
70 ppb	\$0.8	\$1.2 to \$2.1
65 ppb	\$1.5	\$2.3 to \$4.2

Source: EPA, RIA of the Final Revisions to the NAAQS for Ground-Level Ozone, September 2015.

Notes: The data reflect annualized costs and annual monetized benefits of achieving the standard (or a more stringent, 65 ppb option considered, but not adopted) post-2025 in California. Because of more severe pollution, the Clean Air Act will give most areas of California until the 2030s to reach attainment. The agency states that “estimates of costs and benefits for California in a post-2025 time frame are likely to be relatively more uncertain than the national attainment estimates for 2025.” In particular, the agency did not project emissions and air quality for any year other than 2025, although it assumed that emission controls and associated costs would occur through the beginning of 2038; benefits for California were modeled using population demographics in 2038. The estimates assume a 7% discount rate for future costs and benefits.

Industry Estimates

Industry sources have generally estimated the future cost of emission controls necessary to attain a revised ozone NAAQS to be greater than EPA has. A 2015 study by the National Association of Manufacturers (NAM), for example, projected the cost of attaining a more stringent ozone NAAQS, as measured in reduced Gross Domestic Product, at up to \$140 billion annually from 2017 to 2040.⁶⁸

In reaching these conclusions, the NAM study made a number of assumptions different from those in EPA’s 2015 RIA

- The study looked only at the most stringent option in the range proposed by EPA (65 ppb). EPA proposed a standard in the range of 65 to 70 ppb. In EPA’s analysis, the cost of attaining a 65 ppb NAAQS—an option not ultimately chosen by EPA—would be over 10 times that of a 70 ppb NAAQS.
- The NAM study’s baseline differs from that of EPA. It appears not to include some recently promulgated EPA regulations that will reduce NO_x emissions (e.g., the Cross State Air Pollution Rule). It also does not include EPA’s Clean Power Plan, which was finalized after the release of NAM’s study, but before promulgation of the final ozone NAAQS. EPA projected that the Clean Power Plan would cause coal-fired electricity generation to decline 12% to 15% in 2025,⁶⁹ resulting in substantial reductions of NO_x emissions.⁷⁰

⁶⁸ NERA Economic Consulting for the National Association of Manufacturers, *Assessing Economic Impacts of a Stricter National Ambient Air Quality Standard for Ozone*, February 2015, p. S-1, at <http://www.nam.org/Special/Media-Campaign/EPA-Overregulation/Ozone-Regulations.aspx>. Hereinafter, “NAM Report.”

⁶⁹ EPA, Office of Air and Radiation and Office of Air Quality Planning and Standards, *Regulatory Impact Analysis for the Clean Power Plan Final Rule*, August 2015, pp. 3-27, at https://www3.epa.gov/ttnecas1/docs/ria/utilities_ria_final-clean-power-plan-existing-units_2015-08.pdf.

⁷⁰ Although the Supreme Court has stayed implementation of the Clean Power Plan, and EPA has proposed its repeal, coal-fired generation had already declined more than EPA’s 2025 projections by 2017 as a result of market forces, state regulations, and other factors.

- The NAM study concluded that more than half of the emission reductions needed to reach attainment would have to come from “unknown controls,”⁷¹ which, in an earlier version of its study, it estimated could cost as much as \$500,000 per ton of emissions reduced.⁷² EPA’s modeling of the rule’s costs found that unknown controls would play a much smaller role: both the number of tons to which such controls would apply and the cost per ton would be substantially less.
- NAM’s analysis focused exclusively on emissions of NO_x, without any consideration of VOC controls. VOC emissions from petroleum and related industries have increased in the past decade, according to EPA, while emissions from most other sources have declined.⁷³ Recent EPA analyses suggest that there are low cost emission control options in the oil and gas sector.⁷⁴

In 2015, the American Petroleum Institute (API), the American Chemistry Council, and NAM all released state maps showing potential nonattainment areas and the potential cost of the rule on a state-by-state basis.⁷⁵ A map of the entire country distributed by API identified 958 counties nationwide as potentially in violation of a 70 ppb ozone NAAQS.⁷⁶ The larger number of affected counties (by comparison, in 2015, EPA projected only 241 counties⁷⁷) would also contribute to higher cost estimates.

As shown in **Table 2**, the number of nonattainment counties recommended by states (213) and designated by EPA (201) are less than one-fourth of the number assumed in industry projections.

At the state level, the contrast between industry projections and state data is particularly striking: API’s map showed 59 of Oklahoma’s 77 counties potentially in nonattainment; the state data (submitted one year later) indicated that all 77 counties have already attained the 2015 standard. Similarly, API’s map showed Kansas with 75 counties in nonattainment; according to the state’s 2016 submission, the standard has already been attained at every monitored location. In other states—Arizona, Colorado, Indiana, Michigan, Missouri, Texas, and Utah among them—the

⁷¹ NAM Report, p. 2.

⁷² NAM Report, July 2014, pp. 12-19, at <http://www.nam.org/Issues/Energy-and-Environment/Ozone-Regulations/NERA-NAM-Ozone-Full-Report-20140726/>. The \$500,000 figure does not appear in the February 2015 NAM report, but the February report continues to rely on scrappage programs to estimate the cost of unknown controls. NAM’s present value of the cost of all necessary controls is more than six times that of EPA. See NAM Report, p. 10.

⁷³ See EPA, National Emissions Inventory (NEI) Air Pollutant Emission Trends Data, at <http://www.epa.gov/ttn/chieftrends/>. As shown in the NEI, VOC emissions from petroleum and related industries increased 85% between 2008 and 2014. This increase is due in part to improvements in the methodologies used to estimate emissions and the addition of subcategories of sources to the petroleum and related industries category, but available information suggests that the increase is also due in part to greater emissions. Personal communication, EPA Office of Air Quality Planning and Standards, September 6, 2017.

⁷⁴ See, for example, EPA, “Regulatory Impact Analysis, Final New Source Performance Standards and Amendments to the National Emissions Standards for Hazardous Air Pollutants for the Oil and Natural Gas Industry,” April 2012, at http://www.epa.gov/ttnecas1/regdata/RIAs/oil_natural_gas_final_neshap_nsps_ria.pdf.

⁷⁵ See, for example, API, “New Ozone Rules Could Be Most Expensive Regulations Ever,” Ozone State Map Series, at <http://www.api.org/~media/files/policy/environment/economic-impact-ozone/economic-impact-ozone-nm.pdf>.

⁷⁶ See Mark Green, “EPA Fumbles on Unneeded Ozone Regs,” *Energy Tomorrow*, October 2, 2015, at <http://www.energytomorrow.org/blog/2015/10/02/epa-fumbles-on-unneeded-ozone-regs>. *Energy Tomorrow* describes itself as “a project of the American Petroleum Institute ... speaking for the industry to the public, Congress and the Executive Branch, state governments and the media.”

⁷⁷ See EPA, “County-level Design Values for the 2015 Ozone Standards,” at <https://www.epa.gov/ozone-pollution/ozone-data-tables-1997-2008-and-2015-standards>.

number of counties identified on the API map is substantially higher than the number identified by the state and ultimately designated nonattainment by EPA.

Issues

The 2015 ozone NAAQS review has raised issues regarding the cost of attainment, background ozone levels, and the schedule for NAAQS reviews. The adequacy of the ozone monitoring network and the role of federal versus state and local pollution control measures are other important issues. More recently, EPA cited concerns about NAAQS review and implementation and identified “NAAQS reform” as one of four initiatives that the agency plans to undertake to reduce “unnecessary burdens on the development and use of domestic energy resources.”⁷⁸ In particular, EPA’s “Back-to-Basics” memorandum identified principles to guide forthcoming NAAQS reviews.⁷⁹ Among other things, EPA seeks to streamline the NAAQS review process and obtain Clean Air Scientific Advisory Committee advice regarding background pollution and potential adverse effects from NAAQS compliance strategies.⁸⁰ EPA has also formed the “Ozone Cooperative Compliance Task Force” to review issues related to the ozone NAAQS and that the task force “is reviewing administrative options to enable states to enter into cooperative agreements with EPA to provide regulatory relief and meaningfully improve ozone air quality.”⁸¹

The Role of Cost

The issue of cost is a perennial one in NAAQS decisions, even though EPA is prohibited by the Clean Air Act from considering costs in setting the standards. The Clean Air Act’s Section 109 has been so interpreted since the NAAQS provisions were added to the act in 1970; in 2001, this interpretation was affirmed in a unanimous Supreme Court decision, *Whitman v. American Trucking Associations*.⁸² The Court pointed to numerous other CAA sections where Congress had explicitly allowed consideration of economic factors, concluding that if Congress had intended to allow such factors in the setting of a primary NAAQS, it would have been more forthright—particularly given the centrality of the NAAQS concept to the CAA’s regulatory scheme. The court concluded that Section 109(b)(1) “unambiguously bars cost considerations from the NAAQS-setting process.”⁸³

This is not to say that cost considerations play no role in Clean Air Act decisions, including in *implementation* of a NAAQS. Cost-effectiveness is considered extensively by EPA and the states in selecting emission control options to meet the standards. Also, as discussed above, the agency prepares cost and benefit estimates at the time it proposes or promulgates a NAAQS, both for information purposes, and in order to comply with Executive Order 12866, under which the OMB

⁷⁸ EPA, *Final Report on Review of Agency Actions that Potentially Burden the Safe, Efficient Development of Domestic Energy Resources Under Executive Order 13783*, October 25, 2017, p. 2, <https://www.epa.gov/sites/production/files/2017-10/documents/eo-13783-final-report-10-25-2017.pdf>.

⁷⁹ E. Scott Pruitt, EPA Administrator, “Back-to-Basics Process for Reviewing National Ambient Air Quality Standards,” memorandum to EPA Assistant Administrators, May 9, 2018, <https://www.epa.gov/sites/production/files/2018-05/documents/image2018-05-09-173219.pdf>.

⁸⁰ Pruitt, “Back-to-Basics Process.”

⁸¹ EPA, *Final Report on Review of Agency Actions that Potentially Burden the Safe, Efficient Development of Domestic Energy Resources Under Executive Order 13783*, October 25, 2017, p. 5, <https://www.epa.gov/sites/production/files/2017-10/documents/eo-13783-final-report-10-25-2017.pdf>.

⁸² 531 U.S. 457 (2001).

⁸³ *Ibid.* at 471.

requires cost-benefit analysis of economically significant rules. But in deciding what level of ambient pollution poses a health threat, the statute bars consideration of costs.

Some Members of Congress would like to change this, by revising the CAA to require consideration of cost in NAAQS decisions. In the 112th Congress, the House twice passed legislation that would have done so: H.R. 2401 and H.R. 3409 would have required the EPA Administrator to take feasibility and costs into consideration in setting National Ambient Air Quality Standards. The Senate did not pass either bill. In the 114th Congress, H.R. 1388/S. 751 would have required EPA to take into consideration feasibility and cost in setting ozone NAAQS, as well as establishing several other conditions on the Administrator's ozone-NAAQS-setting authority. H.R. 4265 and H.R. 4775 would have allowed the Administrator to consider likely technological feasibility "as a secondary consideration" in establishing and revising NAAQS under certain circumstances. In the 115th Congress, S. 263/H.R. 806 contain similar provisions. The House passed H.R. 806 on July 18, 2017.

Background Ozone Levels

A number of states, particularly in the inter-mountain West, experience what are termed high "background" levels of ozone. As EPA explains

Any ozone formed by processes other than the chemical conversion of local or regional ozone precursor emissions is generically referred to as "background" ozone. Background ozone can originate from natural sources of ozone and ozone precursors, as well as from manmade international emissions of ozone precursors. Natural sources of ozone precursor emissions such as wildfires, lightning, and vegetation can lead to ozone formation by chemical reactions with other natural sources. Another important component of background is ozone that is naturally formed in the stratosphere through interactions of ultraviolet light with molecular oxygen. Stratospheric ozone can mix down to the surface at high concentrations in discrete events called intrusions, especially at higher-altitude locations. The manmade portion of the background includes any ozone formed due to anthropogenic sources of ozone precursors emitted far away from the local area (e.g., international emissions). Finally, both biogenic and international anthropogenic emissions of methane, which can be chemically converted to ozone over relatively long time scales, can also contribute to global background ozone levels.⁸⁴

In the final rule, EPA identified two definitions of background ozone⁸⁵

- natural background (NB) (ozone "that would exist in the absence of any manmade precursor emissions"); and
- United States background (USB) (ozone "that would exist in the absence of any manmade emissions inside the U.S.").

What the definitions have in common is that they identify ozone levels that cannot be influenced by actions within the jurisdiction of concern.

EPA noted in the final rule that "[v]arious commenters maintained that it was inappropriate to revise the current NAAQS based on their view that natural background concentrations in several states are at or above O₃ concentrations associated with meeting a NAAQS set at a level less than

⁸⁴ EPA, 2014 RIA, pp. 2-10 and 2-11.

⁸⁵ 80 *Federal Register* 65327, note 84.

75 ppb (presumably retaining the same indicator, form, and averaging time), making the NAAQS impossible for those states to attain and maintain, a result they claim is legally impermissible.”⁸⁶

The agency did not agree. In the final rule, EPA stated that it had “summarized a variety of modeling-based analyses of background O₃ ... and conducted our own multi-model assessment of USB concentrations across the U.S.... The EPA analyses ... concluded that seasonal mean daily maximum 8-hour average concentrations of USB O₃ range from 25-50 ppb, with the highest estimates located across the intermountain western U.S.”

In response to the comments, the final rule stated that “EPA analyses indicate that there may be infrequent instances in a limited number of rural areas where background O₃ would be appreciable but not the sole contributor to an exceedance of the revised NAAQS, but do not indicate U.S. background (USB) O₃ concentrations will prevent attainment of a revised O₃ standard with a level of 70 ppb.” Additionally, the rule noted that

the courts have clearly established that “[a]ttainability and technological feasibility are not relevant considerations in the promulgation of [NAAQS].” *API v. EPA*, 665 F. 2d 1176, 1185 (D.C. Cir. 1981). Further, the courts have clarified that the EPA may consider proximity to background concentrations as a factor in the decision whether and how to revise the NAAQS only in the context of considering standard levels within the range of reasonable values supported by the air quality criteria and judgments of the Administrator. 79 FR 75242-43 (citing *ATA III*, 283 F. 3d at 379).⁸⁷

Finally, the final rule outlined various forms of regulatory relief allowed under the statute and EPA implementing regulations, including “the exclusion of air quality monitoring data from design value calculations when there are exceedances caused by certain event-related U.S. background influences (e.g., wildfires or stratospheric intrusions)”;⁸⁸ relief from more stringent requirements in areas designated as “rural transport areas”; and the application of CAA Section 179B, which allows EPA to approve state SIP submissions that demonstrate an area would have met the ozone NAAQS by the attainment date if not for international emissions contributing to the area.⁸⁹

The invocation of these regulatory relief measures, as even EPA acknowledged, is not burden-free: each would require some level of assessment or demonstration by a state and/or EPA. States that have tried to invoke the “exceptional event” exceptions have expressed frustration with the lack of clarity and the burden involved in meeting EPA’s data requirements and, thus, may not be confident in the agency’s offer of regulatory relief.⁹⁰ But, as noted earlier (in **Figure 3**), EPA does not believe it will be necessary in most cases to invoke such measures. EPA modeling shows only 14 counties outside of California exceeding a 70 ppb standard without any emission control measures additional to those already promulgated as of this date.

In the 115th Congress, S. 263 and H.R. 806 would change the definition of an exceptional event in Section 319(b)(1) of the Clean Air Act to make it easier for states to exclude air quality monitoring data from the data used to determine nonattainment of a NAAQS. As noted earlier, the House passed H.R. 806 on July 18, 2017.

⁸⁶ 80 *Federal Register* 65327.

⁸⁷ 80 *Federal Register* 65328.

⁸⁸ *Ibid.*

⁸⁹ See EPA, “Tools for Addressing Background Ozone,” https://www.epa.gov/sites/production/files/2015-10/documents/20151001_background_ozone.pdf.

⁹⁰ See, for example, the comments of state and local officials on EPA’s proposed 2012 Exceptional Events guidance, at <http://www.regulations.gov/#/documentDetail;D=EPA-HQ-OAR-2011-0887-0051>.

Schedule for Review

Section 109(d) of the Clean Air Act requires EPA to conduct reviews of the NAAQS and “make such revisions ... as may be appropriate” at five-year intervals. This required schedule is rarely adhered to: the 2015 ozone review took seven and a half years, and as shown in **Table 1**, previous ozone reviews have taken as long as 14 years. Once a review is complete, implementation of a revised standard (i.e., the designation of nonattainment areas and the submittal and review of SIPs) generally takes longer than five years; so if EPA were to meet the statutory NAAQS review schedule, it would be likely that the previous review would still be being implemented at the time the next revised NAAQS was being promulgated.

This has led many in Congress and in various affected industries to suggest that there be a longer time between mandatory reviews of the NAAQS: in the 114th Congress, at least eight bills were introduced that would have changed the required schedule for NAAQS reviews. In the 115th Congress, at least three bills would do so (see “Congressional Reaction” section, below).

Although a change in the mandated schedule might seem to be just a recognition that five years is an insufficient period of time for review, the five-year nondiscretionary deadline serves an important role in the minds of environment and public health groups: it allows them to file suit under the Clean Air Act’s citizen suit provision to establish a judicial deadline for completion of a review. In the minds of plaintiffs, extending a deadline to 10 years would mean a five-year delay before they could establish a court-ordered schedule for such reviews. Thus, there is substantial opposition to what might otherwise seem a mere recognition of reality.

Monitoring

The existing network of ozone monitors is concentrated in urban areas, because of the larger population potentially affected, and because most of the sources of ozone precursor emissions are located in such areas. But, as noted earlier, ozone is not generally emitted directly by pollution sources. It forms in the atmosphere, often downwind of emission sources. Thus, rural areas can have high ozone concentrations. The new form of the secondary NAAQS discussed by EPA suggested a need for additional monitoring in rural areas to detect impacts of ozone on forests and agricultural production. Both EPA and state monitoring budgets are constrained, however, raising questions as to how any additional monitoring requirement would be funded.

The agency, in a 2009 rulemaking separate from the NAAQS, proposed changing the minimum ozone monitoring requirements for both urban and nonurban areas.⁹¹ That proposal would have required that each state operate at least three ozone monitors in nonurban areas. It would also have required at least one ozone monitor in each urban area with a population between 50,000 and 350,000. The requirements were not finalized.

In the final 2015 ozone NAAQS rule, EPA made some adjustments to its monitoring requirements,⁹² including the following:

1. updating the Air Quality Index (AQI) based on the strengthened ozone health standard, to provide the public with the most up-to-date information about air quality where they live;

⁹¹ 74 *Federal Register* 34525, July 16, 2009.

⁹² For a summary of these actions, see EPA, “Updates to the Air Quality Index for Ozone and Ozone Monitoring Requirements,” https://www.epa.gov/sites/production/files/2015-10/documents/20151001_air_quality_index_updates.pdf.

2. revising the monitoring season in 32 states and the District of Columbia, generally by extending the season to require monitoring in additional months;
3. requiring the modernization and streamlining of the Photochemical Assessment Monitoring Stations (PAMS) Network, which helps provide information on ozone formation and transport; and
4. changing the Federal Reference Method for monitoring to include an additional method that is based on advanced technology and monitoring methods.

Although EPA has finalized these changes, the agency is not requiring additional monitors in smaller urban or rural areas.

The absence of ozone monitors in rural areas is another factor that should help mitigate concerns of western states that background levels of ozone will cause rural areas in their states to be designated nonattainment. EPA's policy in designating ozone nonattainment areas has always relied on the submission of EPA-certified monitoring data. Areas without monitors (unless they are contributing to an area with monitored nonattainment) have generally been termed "unclassifiable." When nonregulatory monitors indicate exceedance of the ozone NAAQS, designation as nonattainment does not automatically follow. Rather, the state must first establish regulatory monitors⁹³ and collect three years of data before submitting a proposed designation to EPA.⁹⁴

As of May 2015, approximately 814 counties had ozone monitors, according to EPA, while 2,330 counties did not.⁹⁵

The Role of Federal Versus State and Local Pollution Control Measures

EPA has promulgated more stringent standards for most of the major sources of ozone precursors, including Tier 3 auto emission and fuel standards that began to take effect in 2017 and more stringent standards for power plants that began to take effect in 2015. (For additional information on these standards, see CRS Report R43497, *Tier 3 Motor Vehicle Emission and Fuel Standards* and CRS Report R43851, *Clean Air Issues in the 114th Congress*.) These standards should make the task of demonstrating attainment with a more stringent ozone NAAQS substantially easier. As noted earlier, EPA estimates that nationwide (except in California) already promulgated EPA and state regulations would bring all but 14 counties into attainment of a 70 ppb ozone NAAQS by 2025. Some Members of Congress objected to the standards for motor vehicles, fuels, power plants, and other sources when they were under consideration, but at this date, the net effect of repealing them would be to shift the burden of attaining the ozone NAAQS more squarely in the direction of state and local governments.

A tighter ozone NAAQS has frequently raised the issue of how to control emission sources that contribute to pollution downwind, in other states. Ozone, which forms in the atmosphere from

⁹³ An ambient air monitor used to determine whether an area is in attainment of a NAAQS (a "regulatory monitor") must meet three criteria: it must use methods specified in 40 C.F.R. Part 58, Appendix C; it must meet siting criteria specified in 40 C.F.R. Part 58, Appendix E; and it must meet quality assurance criteria specified in 40 C.F.R. Part 58, Appendix A.

⁹⁴ The Uintah Basin in Utah provides an example. Nonregulatory monitors indicated ozone levels that exceeded the NAAQS in December 2009, January-March 2010, and January-March 2011. The state began collecting regulatory monitoring data in April 2011. The area was not designated nonattainment until April 30, 2018.

⁹⁵ Office of Air Quality Planning and Standards, U.S. EPA, personal communication, May 1, 2015.

chemical reactions of precursor emissions, is the prime example of such downwind pollution. Under both the Bush and Obama Administrations, EPA has addressed this interstate air pollution issue—through the Clean Air Interstate Rule (CAIR, 2005), the Cross State Air Pollution Rule (CSAPR, 2011), and the CSAPR Update Rule (2016).

The D.C. Circuit Court of Appeals found fault with both the CAIR and CSAPR rules, although it allowed CAIR to take effect pending promulgation of an acceptable replacement.⁹⁶ Whether EPA, in the CSAPR rule, had correctly interpreted its authority to control emissions leading to downwind pollution ultimately reached the Supreme Court. On April 29, 2014, in a 6-2 decision (*EPA v. EME Homer City Generation, LLP*), the Court upheld the methodology at the heart of EPA's CSAPR standard-setting process.⁹⁷ The rule was remanded to the D.C. Circuit for consideration of additional issues, but it is now being implemented.

The complexity of establishing controls on air pollution that crosses state lines has suggested to many stakeholders that Congress should revisit the Clean Air Act sections that authorize or require such controls, and numerous bills have been introduced on the subject over the years. Since the last major CAA revision in 1990, however, none of those bills has made it to the floor of the House or Senate. The Supreme Court's decision in the *Homer City* case may have further reduced the odds of congressional action on the subject.

Congressional Reaction

Congress took an interest in what became the 2015 ozone standard even before a proposal was released. Three bills introduced in the 113th Congress would have affected the timing and/or EPA's authority to promulgate an ozone NAAQS. In the 114th Congress, which followed proposal of the standards, there were 15 bills or resolutions introduced to address the revision of the ozone (and, in some cases, other) NAAQS. Two of the bills, H.R. 4775 and H.R. 5538 (§438), passed the House, but were not acted on by the Senate.

In the 115th Congress, as of the August recess, six bills had been introduced that would affect the timing and/or EPA's authority to promulgate an ozone NAAQS⁹⁸

- S. 263 (Senator Capito)/H.R. 806 (Representative Olson), the Ozone Standards Implementation Act, would delay the deadline for designation of nonattainment areas under the 2015 ozone NAAQS revision until October 2025 and the date for State Implementation Plan revisions under the standard until October 2026; would require future reviews of the NAAQS at 10-year rather than five-year intervals; would allow the Administrator to consider, as a secondary consideration, likely technological feasibility in establishing and revising primary NAAQS in cases where the Administrator concludes that a range of levels of air quality for a pollutant are requisite to protect public health with an adequate margin of safety; would require the Administrator to publish regulations and guidance for implementing a new or revised NAAQS concurrently with the publication of the standard; would make changes to EPA's authority to exclude from air quality monitoring data used to determine attainment of NAAQS certain data influenced by "exceptional events"; would require a report to Congress on

⁹⁶ For a discussion of the Bush and Obama Administration regulations and the D.C. Circuit decisions remanding them, see CRS Report R42895, *Clean Air Issues in the 113th Congress: An Overview*.

⁹⁷ *EPA v. EME Homer City Generation, L.P.*, 134 S. Ct. 1584 (2014).

⁹⁸ In addition, an amendment to prohibit implementation and enforcement of the 2015 NAAQS was offered on 7/18/18—but not agreed to—in House deliberations about EPA's 2019 appropriation. See H. Amdt. 920 to H.R. 6147.

the impact of emissions originating outside the United States on attainment and maintenance of NAAQS; and other provisions. H.R. 806, but not S. 263, would require an EPA report to Congress on ozone formation, including the factors contributing to winter ozone formation, and effective control strategies, and would require EPA to incorporate the report's results into regulations and guidance implementing the 2015 ozone NAAQS. H.R. 806 was reported by the Energy and Commerce Committee on July 14, 2017; the bill passed the House on July 18, 2017.

- S. 452 (Senator Flake), the ORDEAL Act of 2017, would delay the enforcement and implementation of the 2015 ozone NAAQS until January 1, 2025, and would require future reviews at 10-year rather than five-year intervals.
- S. 1203 (Senator Hatch) would require the EPA Administrator to establish a program under which he shall defer the designation of an area as a nonattainment area for the eight-hour ozone NAAQS if the area achieves and maintains certain standards under a voluntary early action compact plan.
- H.R. 958 (Representative Sam Johnson), the Wasteful EPA Programs Elimination Act of 2017, would provide that no funds made available under any act may be used by EPA to implement any ozone standard promulgated after its date of enactment, among other provisions.
- H.R. 3354 (Representative Calvert), the Interior, Environment, and Related Agencies Appropriation Act, 2018, in Section 432 would delay the deadlines for designation of nonattainment areas under the 2015 ozone NAAQS revision until October 2025 and the date for State Implementation Plan revisions under the standard until October 2026. The bill was reported by the Appropriations Committee on July 21, 2017.

The ozone NAAQS has also been challenged in court. Twenty-six parties, including 10 states, have challenged the standards in the U.S. Court of Appeals for the District of Columbia (D.C. Circuit). A nearly equal number of parties, including six states and the District of Columbia, have sided with EPA. Oral argument in the case (*Murray Energy v. EPA*) was scheduled for April 19, 2017,⁹⁹ but 12 days before the argument, EPA requested a delay in the proceedings to review the standards. The court granted the agency's request to delay the oral argument and held the case in abeyance pending further orders. EPA was required to file status reports with the D.C. Circuit every 90 days as it reviewed the rule. On August 1, 2018, EPA notified the court that it does not intend to revisit the 2015 standard.¹⁰⁰ The agency also reported that it has begun the next ozone NAAQS review, which will implement the principles from its May 2018 "Back-to-Basics" memorandum, and that it intends to complete this ozone NAAQS review by 2020.¹⁰¹

In addition, lawsuits have been filed challenging EPA's final designation of an area in Wisconsin as attainment—after proposing to designate it nonattainment—with respect to the 2015 standard.¹⁰²

⁹⁹ Clerk's Order, *Murray Energy Corp. v. EPA*, No. 15-1385 (D.C. Cir. Dec. 19, 2016).

¹⁰⁰ Respondent EPA's Final Status Report at 1, 4, *Murray Energy Corp. v. EPA*, No. 15-1385 (D.C. Cir. Aug. 1, 2018).

¹⁰¹ Respondent EPA's Final Status Report at 4, *Murray Energy Corp. v. EPA*, No. 15-1385 (D.C. Cir. Aug. 1, 2018).

¹⁰² See Clerk's Order, *Clean Wisconsin v. EPA*, No. 18-1203 (D.C. Cir. Aug. 3, 2018) (consolidating cases challenging the attainment designation of an area of Wisconsin).

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