# 3 National Ambient Air Quality Standards

As noted in chapter 2, the framework of the present regulatory structure for addressing air pollution was largely put in place by the 1970 amendments to the Clean Air Act (CAA) and has remained the same since that time. The health-and-welfare-based National Ambient Air Quality Standards (NAAQS) are nationwide air quality goals that serve as one of the key building blocks of the scheme for addressing air pollution. The NAAQS are ambient air standards, and *ambient air* is generally defined to mean all outdoor air that is external to buildings and to which the public has access.[1] Congress authorized the Environmental Protection Agency (EPA) to develop primary and secondary NAAQS with the understanding that the primary standards are to be set at a level designed to protect public health; the secondary standards are intended to focus on impacts to the environment, including potential damage to plants and trees.[2]

Although the standards themselves are not directly enforceable, certain state and federal regulations are directly linked to achieving compliance with the NAAQS. Some regulations, discussed in the following chapter on state implementation plans, are intended to establish emission limits and other requirements to "attain" or "maintain" the NAAQS. Moreover, the permitting requirements applicable to the construction of new major stationary sources and major modifications of existing major stationary sources of regulated pollutants are tied to whether a particular

1. 40 C.F.R. § 50.1(e). For more information, see Memorandum from Andrew R. Wheeler, EPA Adm'r, to EPA Reg'l Adm'rs, Revised Policy on Exclusions from "Ambient Air" (Dec. 2, 2019), https://www.epa.gov/nsr/ambient-air-guidance.
2. CAA § 109, 42 U.S.C. § 7409.

region is in attainment or nonattainment with a NAAQS. The following discussion of the NAAQS explains the current standards and the ways in which the standards are established and implemented.

## 3.1 NAAQS Background

Under the CAA, Congress delegated EPA the authority to develop NAAQS based on a careful and thorough review of the science. EPA has currently identified six common air pollutants (called *criteria pollutants*) that have scientifically demonstrated effects on health and the environment at certain levels. These pollutants are sulfur dioxide ($SO_2$), particulate matter (PM), carbon monoxide (CO), ozone ($O_3$), nitrogen dioxide ($NO_2$), and lead (Pb). The primary and secondary standards for these criteria pollutants, which are set out in 40 C.F.R. part 50, establish a ceiling of emission levels that applies throughout the nation. The NAAQS are generally expressed as a maximum acceptable mass of pollutant (micrograms) per standard volume of air (cubic meters) or as a concentration (parts per million (ppm) or parts per billions (ppb)) measured for a specific period of time (e.g., one hour, eight hours, or twenty-four hours). $NO_2$, for example, has a one-hour standard and an annual arithmetic mean standard. An exceedance of a NAAQS is typically measured based on exceeding the standard within a certain period of time. The primary one-hour $NO_2$ NAAQS is exceeded if the three-year average of the 98th percentile of the daily maximum one-hour average at monitors within an area is above 100 ppb.[3] Conversely, the secondary three-hour $SO_2$ NAAQS is exceeded if there is more than one measurement above the standard at area monitors in a year.

The six criteria pollutants are summarized as follows:

*Sulfur dioxide* is primarily emitted from burning sulfur-containing fossil fuels (oil and coal) at power plants and industrial facilities, as well as during the processing of sulfur-containing

3. The 98th percentile corresponds approximately to the seventh or eighth highest one-hour daily average in a year (i.e., 1 percent of 365 days equals 3.65 days). *See* Primary National Ambient Air Quality Standards for Nitrogen Dioxide, 75 Fed. Reg. 6474, 6491 (Feb. 9, 2010) (to be codified at 40 C.F.R. pts. 50, 58).

fuels and ores. Ships, locomotives, and heavy equipment using high-sulfur content fuels also emit $SO_2$. Exposure to high levels of $SO_2$ may impair lung function and aggravate existing respiratory and cardiovascular disease. Children with asthma are particularly sensitive. $SO_2$ is also a precursor of particulate matter, which can aggravate the lungs, impair visibility, and contribute to regional haze. In addition, $SO_2$ can harm trees and plants and is the major precursor of acid rain, which has demonstrated deleterious effects on soils and water bodies, where it can be detrimental to fish and other wildlife.

*Particulate matter* consists of microscopic particles (either liquid droplets or solids) that can be formed in the atmosphere through a chemical reaction or emitted directly by a source, such as combustion processes, motor vehicles, and material handling processes. There are generally two types of particulate classifications, based on size: $PM_{10}$ (coarse particulates with an aerodynamic diameter of less than 10 micrometers) and $PM_{2.5}$ (fine particulates with a diameter of less than 2.5 micrometers). Both $PM_{10}$ and $PM_{2.5}$ present potential health concerns from inhalation, which may result in physical ailments (lung irritation) or chemical exposures (allowing lead or other metal particles to enter the body). Fine particulate matter is a mixture of extremely small particles and liquid droplets that can reach the deepest region of the lungs. $PM_{10}$ and $PM_{2.5}$ also negatively impact visibility and cause regional haze. EPA has established separate $PM_{10}$ and $PM_{2.5}$ NAAQS. Recent developments in setting two separate PM NAAQS are discussed below in section 3.3.

*Carbon monoxide* is a colorless, odorless, tasteless gas primarily emitted due to the incomplete combustion of fuels, such as oil, coal, wood, gasoline, and natural gas. The largest contributors are motor vehicles, power plants, and industrial facilities. Agricultural operations and wood-burning fireplaces also contribute to ambient levels of CO. Studies demonstrate that relatively low levels of CO exposure may aggravate cardiovascular disease and affect the central nervous system.[4] High levels of CO are toxic to humans and other mammals.

4. *Basic Information about Carbon Monoxide (CO) Outdoor Air Pollution*, EPA, https://www.epa.gov/co-pollution/basic-information-about-carbon-monoxide-co-outdoor-air-pollution; *see also* Sharon Wilbur, et al., Toxicological Profile for Carbon Monoxide 24–203 (Agency For Toxic Substances & Disease Registry ed.,

*Ozone* is found in the upper atmosphere or stratosphere, where it serves as a protective shield from the sun's damaging ultraviolet radiation. Ozone is also found at ground level in the troposphere where it is harmful to human health. Ozone is not directly emitted—it forms from chemical reactions of volatile organic compounds (VOCs), nitrogen oxides ($NO_x$), and oxygen in the presence of sunlight. Tropospheric ozone is the primary component of smog. High concentrations of ground-level ozone can damage lung tissue and reduce lung function. Ozone precursors—VOCs and $NO_x$—are emitted by a variety of sources, including most stationary combustion sources (such as boilers, furnaces, power plants, refineries, and chemical plants), motor vehicles, off-road equipment, the storage of petroleum, and the application of paints and solvents.

*Nitrogen dioxide*, at high concentrations, can affect respiratory functions. $NO_2$ is formed when nitric oxide (NO) is oxidized in the atmosphere. NO and $NO_2$ are often referred to as nitrogen oxides. $NO_x$ is generated by the combustion of fuels in boilers, furnaces, and power plants as well as from motor vehicle engines and off-road equipment. $NO_x$ is a precursor to ozone formation, acid rain, and particulate matter. High concentrations of $NO_x$ also negatively impact visibility and regional haze due to resulting nitrate particles.[5]

*Lead* particles may be inhaled or ingested. Sources of lead air emissions, which can be deposited onto the soil and then ingested, include motor vehicles and aircraft burning leaded fuel, ore and metals processing, waste incinerators, and lead-acid battery manufacturing and recycling. Extensive exposure to lead may result in neurological impairments, and it can affect the kidneys, liver, and the blood system since it tends to accumulate in the body rather than being excreted. Lead levels in the ambient air have been reduced substantially since leaded gasoline was phased out for use in on-road vehicles.[6]

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2012), https://www.ncbi.nlm.nih.gov/books/NBK153693/pdf/Bookshelf_NBK153693.pdf.

5. *Basic Information about $NO_2$*, EPA, https://www.epa.gov/no2-pollution/basic-information-about-no2.

6. The 25-year phase-out of leaded gasoline concluded in 1996.

## 3.2 Current NAAQS

The first NAAQS were promulgated in 1971 for photochemical oxidants (now "ozone"), CO, $SO_2$, $NO_2$, PM, and hydrocarbons. The lead standard was added in 1978. EPA delisted hydrocarbons as a criteria pollutant in 1983 because it concluded that hydrocarbons have no direct adverse health effect.[7] Nevertheless, reactive hydrocarbons are a subset of VOCs, which EPA regulates as precursors of ozone formation. The current primary and secondary NAAQS are set out in the table below.

| Pollutant | Averaging Time | National Primary Standards[a] | National Secondary Standards[a] |
|---|---|---|---|
| Sulfur dioxide[b] | Max. 24-hour concentration—1971 standard[b, c] | 0.14 ppm (365 μg/m$^3$) | None |
| | Annual arithmetic mean—1971 standard[b] | 0.03 ppm (80 μg/m$^3$) | None |
| | 1-hour avg. concentration—2010, current standard[d] | 75 ppb | None |
| | 3-hour avg. concentration—1971, current standard | None | 0.5 ppm (1300 μg/m$^3$) |
| Particulate matter ($PM_{10}$)[e] | 24-hour avg. concentration | 150 μg/m$^3$ | 150 μg/m$^3$ |
| ($PM_{2.5}$)[f] | 24-hour avg. concentration | 35 μg/m$^3$ | 35 μg/m$^3$ |
| | Annual arithmetic mean | 12 μg/m$^3$ | 15 μg/m$^3$ |
| Carbon monoxide[g] | 8-hour avg. concentration | 9.0 ppm (10 mg/m$^3$) | None |
| | 1-hour avg. concentration | 35 ppm (40 mg/m$^3$) | None |
| Ozone | 1-hour avg. concentration—1979 standard[h] (revoked) | 0.12 ppm (235 μg/m$^3$) | 0.12 ppm (235 μg/m$^3$) |
| | 8-hour avg. concentration—1997 standard[i] (revoked) | 0.08 ppm (157 μg/m$^3$) | 0.08 ppm (157 μg/m$^3$) |
| | 8-hour avg. concentration—2008 standard[j] | 0.075 ppm | 0.075 ppm (remanded in 2013 and replaced in 2015)[k] |
| | 8-hour avg. concentration—2015 standard[l] | 0.070 ppm | 0.070 ppm[k] |

7. National Primary and Secondary Ambient Air Quality Standards, 48 Fed. Reg. 628 (Jan. 5, 1983) (to be codified at 40 C.F.R. pt. 50).

| | | | |
|---|---|---|---|
| Nitrogen dioxide | Annual arithmetic mean | 53 ppb | 53 ppb |
| | 1-hour avg. concentration[m] | 100 ppb | 100 ppb |
| Lead (Pb) | Quarterly arithmetic mean—1978 standard[n] | 1.5 μg/$m^3$ | 1.5 μg/$m^3$ |
| | Rolling 3-month average—2008, current standard | 0.15 μg/$m^3$ | 0.15 μg/$m^3$ |

*Note:* The primary and secondary standards are set forth as follows: $SO_2$ (40 C.F.R. §§ 50.4 and 50.5), $PM_{10}$ (40 C.F.R. § 50.6), $PM_{2.5}$ (40 C.F.R. § 50.7), CO (40 C.F.R. § 50.8), $O_3$ (40 C.F.R. § 50.9), $NO_2$ (40 C.F.R. § 50.10), and Pb (40 C.F.R. § 50.11).

a. Parenthetical value is an estimated equivalent concentration.

b. EPA revoked the $SO_2$ annual arithmetic mean and the 24-hour concentration standards in the 2010 rule establishing a new one-hour $SO_2$ standard.[8] The 1971 $SO_2$ annual and 24-hour standards remain in effect, however, for any $SO_2$ nonattainment areas existing in 2010 until EPA approves a state implementation plan (SIP) that fully addresses the attainment and maintenance requirements of the newer one-hour $SO_2$ NAAQS.

c. The 24-hour standard, annual arithmetic average, and secondary standard are not to be exceeded more than once per year.

d. To meet the one-hour $SO_2$ standard, the three-year average of the 99th percentile of the daily maximum one-hour average at area monitors must not exceed 75 ppb.

e. Standard is not to be exceeded more than once per year on average over three years.

f. To meet the 24-hour average standard, the three-year average of the 98th percentile of the 24-hour concentrations at area monitors must not exceed 35 μg/$m^3$. To meet the annual arithmetic mean, the three-year average of the weighted annual mean $PM_{2.5}$ concentrations from area monitors must not exceed 12 or 15 μg/$m^3$, as applicable.

g. The eight-hour concentration and one-hour average concentration are not to be exceeded more than once per year.

h. EPA revoked the one-hour standard on June 15, 2005; however, former one-hour ozone designations and classifications were retained for purposes of the anti-backsliding provisions of 40 C.F.R. § 51.905.

i. To meet the 1997 eight-hour standard, the three-year average of the fourth-highest daily maximum eight-hour average ozone concentration measured at area monitors over each year must not exceed 0.08 ppm.

j. To meet the 2008 eight-hour ozone standard, the three-year average of the fourth-highest maximum eight-hour average ozone concentrations measured at area monitors over each year must not exceed 0.075 ppm. In 2016, EPA proposed to revoke the 2008 ozone standard.[9] As of late 2020, EPA had not taken final action on the proposed revocation. For a discussion about EPA's reluctance to move forward, see 83 Fed. Reg. 62,998 (Dec. 6, 2018).

k. The U.S. Court of Appeals for the D.C. Circuit remanded the 2008 0.075 ppm secondary ozone standard to EPA to better explain why it considered this standard to adequately protect public welfare.[10] The court did not revoke or vacate the standard. EPA responded to this remand as part of the 2015 rulemaking to establish the 0.070 ppm secondary ozone standard. In 2019, the D.C. Circuit Court upheld the 0.070 ppm primary ozone standard and remanded the 0.070 ppm secondary ozone standard to EPA for further justification.[11]

l. The ozone NAAQS is met when the three-year average of the annual fourth-highest daily maximum eight-hour average ozone concentration is less than or equal to 0.070 ppm, as determined in accordance with appendix U of 40 C.F.R. part 60.

m. To meet this standard, the three-year average of 98th percentile of the daily maximum one-hour average at monitors within an area must not exceed 100 ppb.

n. The 1.5 μg/$m^3$ calendar quarter average limits are in effect only in areas designated nonattainment for the lead standards prior to the promulgation of the current standards in 2008, and for which SIPs to attain or maintain the new, current standards have not been submitted and approved.[12]

8. *See* Primary National Ambient Air Quality Standard for Sulfur Dioxide, 75 Fed. Reg. 35,520 (June 22, 2010) (to be codified at 40 C.F.R. pts. 50, 53, 58).

9. Implementation of the 2015 National Ambient Air Quality Standards for Ozone: Nonattainment Area Classifications and State Implementation Plan Requirements, 81 Fed. Reg. 81,276 (proposed Nov. 17, 2016) (to be codified at 40 C.F.R. pts. 50, 51).

10. Mississippi v. EPA, 744 F.3d 1334 (D.C. Cir. 2013).

11. Murray Energy Corp. v. EPA, 936 F.3d 597 (D.C. Cir. 2019).

12. *See* National Ambient Air Quality Standards for Lead, 73 Fed. Reg. 66,964 (Nov. 12, 2008) (to be codified at 40 C.F.R. pts. 50, 51, 53, 58).

## 3.3 Procedures to Establish NAAQS

Sections 108 and 109 of the Clean Air Act authorize EPA to establish, review, and revise NAAQS.[13] In a 2001 U.S. Supreme Court decision, the Court largely affirmed EPA's statutory authority to establish and revise NAAQS.[14] In the *Whitman v. American Trucking Associations* decision, the Supreme Court upheld the constitutionality of EPA's process for establishing NAAQS and concluded that the CAA properly delegated legislative authority to EPA to develop the NAAQS. The Supreme Court also reaffirmed that EPA is required to set the standards based on public health considerations, and it is not to consider implementation costs in its standard-setting process.[15]

### 3.3.1 Listing

Section 108(a) requires the agency to first "list" those air pollutants that "may reasonably be anticipated to endanger public health or welfare" and whose presence "in the ambient air results from numerous or diverse mobile and stationary sources."[16] Courts have recognized that EPA has a mandatory duty to list a substance if the agency determines that (1) the substance is an air pollutant, (2) the pollutant is emitted by numerous or diverse sources, and (3) the pollutant's presence in the atmosphere may reasonably be anticipated to endanger public health or welfare.[17] As noted in section 3.1, EPA has thus far "listed" or identified six criteria pollutants subject to regulation.

It is unlikely that EPA will take steps to regulate any new criteria pollutants other than the six that are currently regulated for the simple reason that almost all air pollutants with known or suspected effects on public health or the environment are currently regulated under the CAA. In December 2009, nongovernmental organizations filed a petition requesting that EPA declare carbon dioxide ($CO_2$) a criteria pollutant and establish a NAAQS

13. CAA §§ 108–109, 42 U.S.C. §§ 7408–7409.
14. *See* Whitman v. Am. Trucking Ass'ns, 531 U.S. 457 (2001).
15. *Id.* at 471.
16. CAA § 108(a)(1)(A), (B), 42 U.S.C. § 7408(a)(1)(A), (B).
17. Nat. Res. Def. Council v. Train, 411 F. Supp. 864 (S.D.N.Y. 1976), *aff'd*, 545 F.2d 320 (2d Cir. 1976).

limit.[18] As of 2020, EPA had not taken action on the petition, and as discussed in chapter 13, EPA has instead taken steps to regulate greenhouse gas emissions by setting standards under Title I (stationary sources) and Title II (mobile sources) of the CAA. As discussed in this chapter, the process of establishing the NAAQS is lengthy and time-consuming, and at present the agency appears to have no plans to seek to regulate greenhouse gases under a new NAAQS.[19]

### 3.3.2 Criteria Document

For each listed pollutant, EPA must issue *air quality criteria*—scientific support for regulating such pollutants—which are embodied in a Criteria Document. Within 12 months of listing a pollutant pursuant to CAA section 108, EPA must issue a Criteria Document, which is intended to "accurately reflect the latest scientific knowledge useful in indicating the kind and extent of all identifiable effects on public health or welfare, which may be expected from the presence of [a] pollutant in the ambient air."[20] Preparation of the Criteria Document begins with an extensive review of available health and welfare scientific information on the criteria pollutant. EPA will also publish a notice in the *Federal Register*, requesting submissions of relevant scientific studies and reports. The Criteria Document is developed in chapters and peer-reviewed extensively during the process.

EPA is required by the Clean Air Act to submit the Criteria Document to an independent, seven-member scientific review committee. EPA appoints the members of the committee, which must include one member of the National Academy of Sciences, one physician, and one person representing state air pollution control agencies. The primary responsibility of the committee, now known as the Clean Air Scientific Advisory Committee (CASAC),[21] is to advise EPA of any appropriate revisions to

18. *See* Center for Biological Diversity, Petition to Establish National Pollutant Limits for Greenhouse Gases Pursuant to the Clean Air Act, Dec. 2, 2009, https://www.biologicaldiversity.org/programs/climate_law_institute/global_warming_litigation/clean_air_act/pdfs/Petition_GHG_pollution_cap_12-2-2009.pdf.

19. Howard M. Crystal, Kassie Siegel, Maya Golden-Krasner & Clare Lakewood, *Returning to Clean Air Act Fundamentals: A Renewed Call to Regulate Greenhouse Gases under the National Ambient Air Quality Standards (NAAQS) Program*, 31 GEO. ENV'T L. REV. 233, 235 (2019).

20. CAA § 108(a)(2), 42 U.S.C. § 7408(a)(2).

21. CAA § 109(d)(2), 42 U.S.C. § 7409(d)(2).

the existing NAAQS or recommend adoption of a new NAAQS. CASAC has an advisory role only, although EPA must provide an explanation if it does not follow CASAC's recommendations.

### 3.3.3 Setting NAAQS

CAA section 109 establishes mechanisms for actually proposing and adopting national primary and secondary NAAQS for each pollutant for which air quality criteria have been issued. For any air pollutant listed after December 31, 1970, section 109 provides that the agency shall issue proposed primary and secondary NAAQS at the time the air quality criteria are issued, and such proposed NAAQS shall be finalized after EPA considers any public comments.[22]

### 3.3.4 Primary NAAQS

Section 109 of the CAA requires that the primary NAAQS be set at a level that will protect public health with an adequate margin of safety.[23] EPA has interpreted this phrase to require setting the NAAQS at levels below those at which adverse health effects have been detected or expected for sensitive and at-risk groups of people (e.g., children and asthmatics).

There is some confusion over how much evidence is necessary to demonstrate that a pollutant may cause an "adverse health effect." However, courts have generally deferred to EPA's policy judgment so long as the agency has provided an explanation of why the evidence in the record supports a particular conclusion and that such conclusion is not irrational or contrary to the statute.

In *Lead Industries Association v. EPA*,[24] for example, the D.C. Circuit upheld EPA's promulgation of the NAAQS for lead, which was established at a level below what was known to be clearly harmful to health. The court reasoned that Congress had directed EPA to allow an adequate margin of safety to "protect against effects which have not yet been uncovered by research and effects whose medical significance is a matter of disagreement."[25] In *Lead Industries*, the court concluded that as long as there is evidence in the record that substantiates the conclusions about

22. CAA § 109(a)(1)(B), (a)(2), 42 U.S.C. § 7409(a)(1)(B), (a)(2).
23. CAA § 109(b)(1), 42 U.S.C. § 7409(b)(1).
24. Lead Indus. Ass'n v. EPA, 647 F.2d 1130 (D.C. Cir. 1980).
25. *Id.* at 1154.

the health effects on which the standards are based, they will be upheld.[26]

Conversely, in *American Lung Association v. EPA*, the court concluded that EPA had not explained its decision to not revise the $SO_2$ NAAQS with precision; thus, it remanded the matter to the agency for further proceedings.[27] In *American Lung Association*, the court reasoned that the "agency has the heaviest obligation to explain and expose every step of its reasoning."[28]

### 3.3.5 Adequate Margin of Safety

When determining whether a NAAQS protects public health "with an adequate margin of safety," EPA evaluates the nature and severity of the health effects in question, the types of health evidence, the kind and degree of uncertainties involved, and the size and nature of the sensitive populations at risk. Generally, the scientific evidence reveals no bright-line standard for setting a NAAQS for a criteria pollutant; however, the courts have granted a fair amount of deference to EPA's scientific judgments in setting NAAQS.

In *American Trucking Associations v. EPA*, the D.C. Circuit reviewed the 1997 ozone and $PM_{2.5}$ NAAQS and held that "EPA has no obligation either to identify an accurate 'safe level' of a pollutant or to quantify precisely the pollutant's risks prior to setting primary NAAQS.[29] Rather, EPA must err on the side of caution . . . setting the NAAQS at whatever level it deems is necessary and sufficient to protect public health with an adequate margin of safety, taking into account both the available evidence and the inevitable scientific uncertainties."[30]

EPA also takes the position that the economic and technological feasibility of controls needed to implement the NAAQS are *not* to be considered in setting the standards. This position has been supported by several D.C. Circuit appellate decisions.[31]

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26. *Id.* at 1155.
27. Am. Lung Ass'n v. EPA, 134 F.3d 388, 393 (D.C. Cir. 1998).
28. *Id.* at 392.
29. Am. Trucking Ass'ns v. EPA, 283 F.3d 355, 378 (D.C. Cir. 2002).
30. *Id.*
31. *Lead Indus. Ass'n*, 647 F.2d at 1161; Am. Petroleum Inst. v. Costle, 665 F.2d 1176, 1185 (D.C. Cir. 1981); Nat. Res. Def. Council v. EPA, 902 F.2d 962, 969 (D.C. Cir. 1990), *vacated in part on other grounds*, Nat. Res. Def. Council v. EPA, 921 F.2d 326 (D.C. Cir. 1991); *Am. Lung Ass'n*, 134 F.3d at 389.

For example, in *Lead Industries*, the court, in reviewing the CAA's legislative history, determined that economic and technological feasibility are not to be considered in setting a NAAQS.[32] In 2001, the U.S. Supreme Court reached the same conclusion in *Whitman v. American Trucking Associations*, noting that "[t]he text of [section] 109, interpreted in its statutory and historical context and with appreciation for its importance to the CAA as a whole, unambiguously bars cost considerations from the NAAQS-setting process."[33] In *Michigan v. EPA*, the U.S. Supreme Court reasoned that the *American Trucking* decision merely establishes a "modest principle" wherein the CAA expressly directs EPA to regulate on the basis of a factor that on its face does not include cost, and the CAA normally should not be read as implicitly allowing EPA to consider cost. The *Michigan* opinion went on to conclude that the principle in the *American Trucking* opinion had no application in determining "appropriate and necessary," which is a far more comprehensive criterion than "requisite to protect the public health"; in the *Michigan* case, the U.S. Supreme Court held the term plainly subsumes consideration of cost.[34]

### 3.3.6 Secondary NAAQS

Secondary standards are created to protect public welfare from known or anticipated adverse effects from exposure to a pollutant in the ambient air.[35] CAA section 302 defines *public welfare* to include effects on the environment in soils, water bodies, vegetation, wildlife, animals, and so forth.[36]

The distinction between primary and secondary standards is not too significant. Most secondary standards are the same as the primary NAAQS because EPA has found this standard to protect both public health and the environment, although there are a few exceptions. The primary and secondary annual standards for $PM_{2.5}$ are different; there is no primary standard for the $SO_2$ three-hour standard; and there is no secondary standard for CO, the $SO_2$ one-hour standard, or the $NO_2$ one-hour standard.

32. *Lead Indus. Ass'n*, 647 F.2d at 1148–49.
33. Whitman v. Am. Trucking Ass'ns, 531 U.S. 457, 471 (2001).
34. Michigan v. EPA, 576 U.S. 743, 755 (2015).
35. CAA § 109(b)(2), 42 U.S.C. § 7409(b)(2).
36. CAA § 302(h), 42 U.S.C. § 7602(h).

### 3.3.7 Units of Measurement

Each of the standards is expressed in terms of a maximum acceptable concentration of the regulated pollutant in the ambient air, including either a parts per million (ppm) or parts per billion (ppb) concentration or a mass of pollutant per volume of air averaged over a period of time. For example, the CO one-hour primary NAAQS is an average concentration standard of 35 ppm, which is equivalent to 40 micrograms per cubic meter ($\mu g/m^3$).

### 3.3.8 Revocation of NAAQS and Anti-Backsliding Requirements

When EPA establishes a new NAAQS for a particular pollutant, it may revoke the prior NAAQS. If EPA exercises its authority to revoke an existing NAAQS, then EPA must also establish requirements applicable to existing nonattainment areas under the CAA's anti-backsliding provisions.[37] The nonattainment designations associated with a particular NAAQS are effectively revoked when the NAAQS is revoked, and the anti-backsliding provisions replace the prior nonattainment requirements. The anti-backsliding requirements continue to apply to the area previously designated as nonattainment until the area meets the five statutory criteria set forth in section 107(d)(3)(E) of the CAA. Once an area meets those criteria, which are the same as those for redesignation from nonattainment to attainment, EPA could then terminate the anti-backsliding obligations for that area.[38] If EPA does not revoke a prior NAAQS, that standard continues to remain in full force and effect even though there is a newer standard, and areas designated as nonattainment based on the prior NAAQS would continue to implement the applicable nonattainment rules until the area is formally redesignated as attainment for that standard.

### 3.3.9 Five-Year Review Cycle

Under the CAA, EPA is required to review the NAAQS every five years and, if appropriate, revise the standards.[39] EPA must consider the latest scientific and technical data on each criteria pollutant. If supported by the scientific and technical assessment,

37. S. Coast Air Quality Mgmt. Dist. v. EPA, 472 F.3d 882 (D.C. Cir. 2006).

38. S. Coast Air Quality Mgmt. Dist. v. EPA, 882 F.3d 1138 (D.C. Cir. 2018); *see, e.g.*, Air Plan Approval; Texas; Dallas-Fort Worth Area Redesignation and Maintenance Plan for Revoked Ozone National Ambient Air Quality Standards, 85 Fed. Reg. 19,096 (Apr. 6, 2020).

39. CAA § 109(d)(1), 42 U.S.C. § 7409(d)(1).

EPA may propose revisions to the existing air quality criteria and ambient air quality standard. Periodic review of the NAAQS is a time-consuming and often controversial process. EPA typically takes longer than five years to review the status of the science on particular criteria pollutants. This delay has often resulted in litigation being filed against the agency to force it to establish a schedule for the revision process.

At the end of the agency's periodic review of a NAAQS, the EPA administrator will make a decision on whether a revision to a NAAQS is warranted or if the status quo should be maintained. Before making a decision, the EPA administrator will take into account the advice and recommendations offered by the CASAC (discussed above in section 3.3.2).

### 3.3.10 Recent NAAQS Five-Year Reviews

The following summarizes some of the background on implementing the NAAQS listed in the table in section 3.1.

*Ozone*—On July 18, 1997, EPA promulgated a revised $O_3$ NAAQS that substituted a new 0.08 ppm primary standard measured over eight hours for the previously existing one-hour standard of 0.12 ppm established in 1979.[40] Subsequently, EPA again lowered the eight-hour ozone standard in March 2008,[41] from 0.08 ppm to 0.075 ppm. (The prior standard was effectively 0.084 ppm due to rounding.) Following its next review cycle in 2015, EPA again lowered the eight-hour standard, this time from 0.075 ppm to 0.070 ppm.[42] On December 31, 2020, EPA followed CASAC's recommendation and decided to make no changes to the ozone standards.[43]

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40. National Ambient Air Quality Standards for Ozone, 62 Fed. Reg. 38,856 (July 18, 1997) (to be codified at 40 C.F.R. pt. 50).

41. National Ambient Air Quality Standards for Ozone, 73 Fed. Reg. 16,436 (Mar. 27, 2008) (to be codified at 40 C.F.R. pts. 50, 58). Following petitions for review, the D.C. Circuit Court determined that EPA could revoke the 1997 standards only if adequate anti-backsliding requirements were adopted. *S. Coast Air Quality Mgmt. Dist.*, 882 F.3d at 1158.

42. National Ambient Air Quality Standards for Ozone, 80 Fed. Reg. 65,292 (Oct. 26, 2015) (to be codified at 40 C.F.R. pts. 50, 51, 52, 53, 58).

43. Review of the Ozone National Ambient Air Quality Standards, 85 Fed. Reg. 87,256 (Dec. 31, 2020); *see also* Letter from Dr. Louis Anthony Cox, Jr., Chair, Clean Air Scientific Advisory Comm., to Andrew R. Wheeler, EPA Adm'r, CASAC Review of the EPA's Policy Assessment for the Review of the Ozone National Ambient Air Quality Standards (Feb. 19, 2020), https://yosemite.epa.gov/sab/sabproduct.nsf/LookupWebProjectsCurrentCASAC/4713D217BC071034852 58515006359BA/$File/EPA-CASAC-20-003.pdf.

*Particulate Matter*—From 1971 through 1987, EPA had established particulate matter NAAQS only for total suspended particulates matter (TSP). In 1987, EPA promulgated 24-hour and annual, primary, and secondary NAAQS for $PM_{10}$. The 24-hour standard was 150 $\mu g/m^3$, not to be exceeded more than once per year on an average, over a three-year period, and the annual standard was 50 $\mu g/m^3$, annual arithmetic mean, averaged over three years.[44] Ten years later in 1997, EPA kept the 24-hour and annual levels for $PM_{10}$ while changing the measurement to the 99th percentile averaged over three years. The 1997 $PM_{10}$ NAAQS were later vacated, and the standards essentially reverted to the 1987 NAAQS.

In 1997, EPA also promulgated, for the first time, NAAQS for $PM_{2.5}$. EPA set the primary and secondary 24-hour standard at 65 $\mu g/m^3$ based on the 98th percentile averaged over three years, and the primary and secondary annual standard at 15 $\mu g/m^3$ based on an annual arithmetic mean, averaged over three years.[45]

Following its first five-year review of the $PM_{2.5}$ NAAQS in 2006, EPA maintained the annual $PM_{2.5}$ standard and lowered the daily standard from 65 $\mu g/m^3$ to 35 $\mu g/m^3$.[46] EPA also decided to maintain the same primary and secondary 24-hour $PM_{10}$ standards and to revoke the annual $PM_{10}$ NAAQS. During its next review cycle, in 2012, EPA lowered the primary annual $PM_{2.5}$ NAAQS from 15 $\mu g/m^3$ to 12 $\mu g/m^3$ while maintaining the secondary standard at 15 $\mu g/m^3$. EPA also maintained the primary and secondary 24-hour standards for $PM_{2.5}$ and $PM_{10}$ without revision in 2012.[47] Subsequently, in December 2020, EPA decided to make no changes to the $PM_{2.5}$ and $PM_{10}$ standards.[48]

*Sulfur Dioxide*—In May 1996, EPA announced that it would not revise the $SO_2$ NAAQS, and this final decision was appealed

44. Revisions to the National Ambient Air Quality Standards for Particulate Matter, 52 Fed. Reg. 24,634 (July 1, 1987) (to be codified at 40 C.F.R. pt. 50).

45. National Ambient Air Quality Standards for Particulate Matter, 62 Fed. Reg. 38,652 (July 18, 1997) (to be codified at 40 C.F.R. pt. 50).

46. National Ambient Air Quality Standards for Particulate Matter, 71 Fed. Reg. 61,144 (Oct. 17, 2006) (to be codified at 40 C.F.R. pt. 50).

47. National Ambient Air Quality Standards for Particulate Matter, 78 Fed. Reg. 3085 (Jan. 15, 2013) (to be codified at 40 C.F.R. pts 50, 51, 52, 53, 58).

48. Review of the National Ambient Air Quality Standards for Particulate Matter, 85 Fed. Reg. 82,684 (Dec. 18, 2020) (to be codified at 40 C.F.R. pt. 50); Review of the National Ambient Air Quality Standards for Particulate Matter, 85 Fed. Reg. 24,094 (proposed Apr. 30, 2020) (to be codified at 40 C.F.R. pt. 50).

by several nongovernmental organizations. In 1998, the D.C. Circuit held in *American Lung Association v. EPA*[49] that the agency had not adequately explained its decision and remanded EPA's $SO_2$ determination to the agency for further proceedings. EPA took action in June 2010 to revise the $SO_2$ NAAQS by establishing a new one-hour $SO_2$ NAAQS at 75 ppb.[50] EPA revoked the prior annual standard because the agency concluded that it would not add to the public health protections afforded by the new one-hour standard. EPA also retained the existing secondary $SO_2$ NAAQS. In 2012, EPA decided to retain without revision the existing 1971 secondary three-hour $SO_2$ standard,[51] and in 2019, the agency decided to retain the existing primary $SO_2$ standard without revision.[52]

*Nitrogen Dioxide*—In February 2010, EPA established a new primary one-hour $NO_2$ NAAQS at 100 ppb, which was not changed during the 2018 review.[53] EPA has, to date, always retained the primary and annual secondary annual $NO_2$ standard of 53 ppb originally established in 1971.[54]

*Lead*—The lead NAAQS was revised in November 2008, and the primary NAAQS was reduced from 1.5 $\mu g/m^3$, set in 1978, to 0.15 $\mu g/m^3$ measured as total suspended particles.[55] In 2016, EPA decided to retain the lead standards without revision.[56]

*Carbon Monoxide*—EPA established the primary standards in 1971 and continues to retain them, most recently in 2011.[57]

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49. 134 F.3d 388 (D.C. Cir. 1998).

50. Primary National Ambient Air Quality Standard for Sulfur Dioxide, 75 Fed. Reg. 35,520 (June 22, 2010) (to be codified at 40 C.F.R. pts. 50, 53, 58).

51. Secondary National Ambient Air Quality Standards for Oxides of Nitrogen and Sulfur, 77 Fed. Reg. 20,218 (Apr. 3, 2012) (to be codified at 40 C.F.R. pt. 50).

52. Review of the Primary National Ambient Air Quality Standards for Sulfur Oxides, 84 Fed. Reg. 9866 (Mar. 18, 2019) (to be codified at 40 C.F.R. pt. 50).

53. Primary National Ambient Air Quality Standards for Nitrogen Dioxide, 75 Fed. Reg. 6474 (Feb. 9, 2010) (to be codified at 40 C.F.R. pts. 50, 58); Review of the Primary National Ambient Air Quality Standards for Oxides of Nitrogen, 83 Fed. Reg. 17,226 (Apr. 18, 2018) (to be codified at 40 C.F.R. pt. 50).

54. Secondary National Ambient Air Quality Standards for Oxides of Nitrogen and Sulfur, 77 Fed. Reg. at 20,218.

55. National Ambient Air Quality Standards for Lead, 73 Fed. Reg. 66,964 (Nov. 12, 2008) (to be codified at 40 C.F.R. pts. 50, 51, 53, 58).

56. Review of the National Ambient Air Quality Standards for Lead, 81 Fed. Reg. 71,906 (Oct. 18, 2016) (to be codified at 40 C.F.R. pt. 50).

57. Review of National Ambient Air Quality Standards for Carbon Monoxide, 76 Fed. Reg. 54,294 (Aug. 31, 2011) (to be codified at 40 C.F.R. pts. 50, 53, 58).

## 3.4 NAAQS Implementation

The NAAQS represent a ceiling of air pollution concentrations that apply throughout the nation. As such, the primary NAAQS form the basis for regulating air emissions for the entire country and provide the foundation for setting specific emission rate limits for most types of large stationary sources, such as power plants and manufacturing facilities, as well as mobile sources. Although the NAAQS are theoretically not directly enforceable, they do set ambient air levels that should not be exceeded; thus, they serve as the basis for the development and approval of federal emission standards as well as SIP rules, which can impose enforceable emission limits and other requirements on contributing sources.

### 3.4.1 Air Quality Control Regions

Section 107 of the CAA requires that EPA, in consultation with appropriate state and local authorities, designate separate air quality control regions (AQCRs) throughout the entire country. Many AQCRs are delineated around major urban population centers and across state lines. For example, portions of Northern Virginia, the District of Columbia, and Southern Maryland make up the Washington, D.C., metropolitan AQCR. A listing of AQCRs is set forth in 40 C.F.R. part 81, appendix A.

The AQCRs, or portions thereof, are designated as being in attainment with the NAAQS (i.e., where air pollution concentrations are below the NAAQS) for each particular criteria pollutant or unclassifiable, or in nonattainment (i.e., above the NAAQS). Part 81 subpart C lists these designations by state for each NAAQS, and most designations are applicable on at least a county-wide basis (although smaller areas are sometimes designated based on the pollutant and emission sources).

Except for $SO_2$ nonattainment designations, determinations are based on data from ambient air quality monitors placed in strategic locations, typically in urban areas, near heavily traveled roadways, or near industrial facilities. The ambient monitors will pick up natural, non-manmade emission sources, which can contribute to an area's overall concentration of a particular pollutant. For example, pine trees emit VOCs, which can contribute

to ground-level concentrations of ozone.[58] Some extreme natural events can result in skewed data, and EPA allows data collected in limited situations to be excluded.[59] EPA requires states to submit annual monitoring network plans, which are separate from and not part of their state implementation plans, to ensure adequate ambient monitoring stations are in place.[60]

For the one-hour $SO_2$ standard only, monitoring data and computer modeling data can be used to establish nonattainment status. EPA decided to allow computer modeling data to be used for areas with larger and manmade sources and monitors where there are a number of smaller sources. EPA has confidence in this approach because the agency has been able to verify the accuracy of the $SO_2$ computer models for this purpose.[61]

If insufficient data exists to make a determination, the area is designated as "unclassifiable" and generally treated as if it is in attainment. This type of designation often occurs in areas where no ambient monitoring stations have been established due to the rural nature of the area, lack of major sources in the area, or lack of resources.

Nonattainment/attainment designations are made on a per-pollutant basis. Because there are six criteria pollutants, an AQCR could be designated as being in attainment with five of the NAAQS and in nonattainment for the remaining NAAQS.

When EPA establishes a new NAAQS or revises an existing one, EPA should make its designations as to whether an area is in attainment or not with the standard within two years. Within three years, states should submit to EPA their implementation plans demonstrating that they have a program in place to implement the new or revised NAAQS ("infrastructure SIPs"). Within 18 to 36 months after nonattainment designations, depending on the

58. David J. Nowak & Gordon M. Heisler, *Air Quality Effects of Urban Trees and Parks*, Nat'l Recreation & Park Ass'n 22–23 (2010).

59. The D.C. Circuit Court of Appeals recognized EPA's broad discretion in defining what is considered a natural event for purposes of excluding data in *Nat. Res. Def. Council v. EPA*, 869 F.2d 459 (2018).

60. In 2019, the D.C. Circuit Court of Appeals upheld EPA's position on this in *Sierra Club v. EPA*, 925 F.3d 490 (2019).

61. Primary National Ambient Air Quality Standard for Sulfur Dioxide, 75 Fed. Reg. 35,520 (June 22, 2010) (to be codified at 40 C.F.R. pts. 50, 53, 58).

pollutant, states must submit implementation plans with details on how they plan to reduce emissions and meet the air quality standards.

### 3.4.2 Classifications and Compliance Deadlines

For nonattainment areas, the CAA establishes specific classifications based on the severity of nonattainment for ozone and $PM_{10}$. For ozone, the classifications are extreme, severe, serious, moderate, or marginal. For each classification, Congress required attainment as expeditiously as practicable but by no later than 3 to 20 years after November 15, 1990, based on the severity of nonattainment. For example, areas classified as marginal for ozone were given three years after November 15, 1990, to comply; moderate, 6 years; serious, 9 years; severe, 15 years; and extreme, 20 years. When EPA establishes a new ozone NAAQS, it sets a new scale to establish the severity of nonattainment and a new schedule for attainment for each of the five different classifications.[62]

Sometimes an area may fail to reach attainment of the applicable ozone NAAQS by the established deadline. If a state anticipates missing a deadline, extensions may be available if certain criteria are met. If an area fails to reach attainment within six months following the applicable attainment date (and any extension), the area could be reclassified to the next higher level (called a "bump-up"). States may also voluntarily request a reclassification to a higher level.

For $PM_{10}$, Congress established two classifications, moderate and serious, and required attainment within at least six to ten years, respectively.[63] Subsequently, EPA established classifications and attainment deadlines for the $PM_{2.5}$ NAAQS.[64] Extensions of these deadlines are possible under certain circumstances, and EPA may also grant waivers if it determines that manmade sources do not contribute significantly to the violation of the ambient standard.

62. For example, in 2018 EPA established thresholds for classifications associated with nonattainment areas for the 2015 ozone NAAQS. *See* Implementation of the 2015 National Ambient Air Quality Standards for Ozone: Nonattainment Area Classifications Approach, 83 Fed. Reg. 10,376 (Mar. 9, 2018) (to be codified at 40 C.F.R. pt. 51).

63. CAA § 188, 42 U.S.C. § 7513.

64. 40 C.F.R. §§ 51.1002–51.1005.

### 3.4.3 Implications of Designations and Classifications

The attainment/nonattainment designations have different goals and trigger separate air regulatory requirements. For example, the goal for attainment areas is to make sure the AQCR stays in attainment with each NAAQS. To help accomplish this goal, the CAA and EPA implementing regulations set out an elaborate procedure for permitting new major stationary sources and major modifications of existing major stationary sources. When this permitting is triggered, the new or modified equipment must use the "best available control technology," determined on a case-by-case basis and taking into account costs and benefits of the resulting reduction in emissions. In addition, the project should ensure that its emissions would not result in or contribute to violations of a NAAQS.[65]

The goal for nonattainment areas is to reduce emissions and improve ambient air quality so the AQCR achieves attainment status, and states must therefore focus on not only new and modified major stationary sources but also existing stationary sources of all sizes as well as mobile sources.

For nonattainment areas, each state initiates a step-by-step process to adopt enforceable SIP emission control regulations designed to achieve attainment status. To meet the objective of achieving attainment, the state or local air emission control agency will adopt various emission control standards for specific sources or categories of sources such as reasonably available control technology (RACT) standards that apply to existing stationary sources. A state could place restrictions on the type of fuels that mobile sources can use and also require vapor recovery at gas station refueling pumps. The higher (more serious) the nonattainment classification, the more requirements a state is likely to establish. Emissions from new and modified major stationary sources cannot result in an increase of a nonattainment pollutant, requiring the source to find offsets from shutdown units in a form of emissions trading. In addition, more stringent, "lowest achievable emission rate" control technology must be used on the new/modified source in nonattainment areas.

65. Memorandum from Stephen D. Page, Dir., EPA Off. of Air Quality Plan. & Standards, to EPA Reg'l Air Div. Dirs., Guidance Concerning the Implementation of the 1-hour $SO_2$ NAAQS for the Prevention of Significant Deterioration Program, at 8 (Aug. 23, 2010) (on file with EPA).

Each of the emission reduction strategies and standards for attainment and nonattainment areas will ultimately be imposed through a federal implementation plan (FIP), delegated by EPA to a state, or approved by EPA as part of the state's SIP. Chapter 4 includes a discussion about FIPs, delegations, and SIP approvals.