United States Court of Appeals

FOR THE DISTRICT OF COLUMBIA CIRCUIT

Argued October 10, 2013 Decided May 27, 2014

No. 12-1238

CENTER FOR BIOLOGICAL DIVERSITY, ET AL.,
PETITIONERS

v.

ENVIRONMENTAL PROTECTION AGENCY AND GINA MCCARTHY,
RESPONDENTS

AMERICAN PETROLEUM INSTITUTE AND UTILITY AIR REGULATORY GROUP,
INTERVENORS

On Petition for Review of a Final Agency Action
of the United States Environmental Protection Agency

Kevin P. Bundy argued the cause for petitioners. With him on the briefs were *Kassia R. Siegel*, *Charles McPhedran*, and *David S. Baron*.

Daniel R. Dertke, Attorney, U.S. Department of Justice, argued the cause and filed the brief for respondents.

Andrea Bear Field, *Lucinda Minton Langworthy*, and *Aaron M. Flynn* were on the brief for intervenors American Petroleum Institute, et al. in support of respondents.

Before: KAVANAUGH, *Circuit Judge*, and SENTELLE and RANDOLPH, *Senior Circuit Judges*.

Opinion for the Court filed by *Senior Circuit Judge* RANDOLPH.

RANDOLPH, *Senior Circuit Judge*: This petition for judicial review deals mainly with what is popularly known as "acid rain."

The Environmental Protection Agency decided in 2012, after an exhaustive rulemaking proceeding, that it needed further studies before it could set a new, joint, "secondary" national ambient air quality standard for oxides of nitrogen and oxides of sulphur, and other related compounds found in the ambient air and considered precursors of acid deposits on the land and in the waters of the continental United States. Secondary National Ambient Air Quality Standards for Oxides of Nitrogen and Sulphur, 77 Fed. Reg. 20,218, 20,226 (Apr. 3, 2012) [Final Rule]. EPA's failure to issue a new multi-pollutant rule at that time, petitioners claim, violated the Clean Air Act.

I

We begin with a brief description of the subjects of EPA's rulemaking.

A

The ambient air—the air we breathe—is made up of approximately 80 percent non-reactive nitrogen (N_2) and 20 percent oxygen (O_2). Like oxygen, nitrogen is essential to what we think of as life. *See Ag 101: Nitrogen*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/oecaagct/ag101/impactnitrogen.

html (last updated June 27, 2012). This is so both as a matter of biochemistry—nitrogen is "an essential nutrient required by all living organisms," *id.*—and as a matter of global economics. The mass agriculture that feeds the world's population is reliant on nitrogen, which is "normally supplied in the form of organic or inorganic fertilizers." Margaret Rosso Grossman, *Nitrates from Agriculture in Europe: The EC Nitrates Directive and Its Implementation in England*, 27 B.C. ENVTL. AFF. L. REV. 567, 567 (2000).

But nitrogen takes many forms, some of which are harmful to the environment. Oxides of nitrogen (NO_y), ammonia (NH_3), and ammonium (NH_4),[1] together with oxides of sulphur (SO_x) in the ambient air, "undergo a complex mix of reactions in gaseous, liquid, and solid phases to form various acidic compounds." Final Rule, 77 Fed. Reg. at 20,224-25. Those compounds are, in turn, "removed from the atmosphere through deposition." *Id.* at 20,225. "Wet" deposition occurs when the compounds return to earth through rain, snow, sleet, hail, fog, and dew. "Dry" deposition occurs when gases and particles of these compounds drop onto Earth without mixing with water in the atmosphere. *Id.*

Wet deposition has attracted most popular attention, but EPA has estimated that "[d]ry deposition now accounts [for] 20-60%" of total acid deposition. *Causes of Acid Rain*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/region1/eco/acidrain/causes.html (last visited May 2014). EPA's number is a very rough estimate because dry deposition is "not easily measured" and because "[v]ery little falls at one time or at one location." *Id.*;

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[1] Ammonia and ammonium are considered "reduced" forms of nitrogen. Reduced nitrogen is abbreviated NH_x. U.S. ENVTL. PROT. AGENCY, REACTIVE NITROGEN IN THE UNITED STATES, at ES-4 n.5 (2011) [REACTIVE NITROGEN].

see Final Rule, 77 Fed. Reg. at 20,249 (attributing the lack of data about dry deposition to "the lack of efficient measurement technologies"). The shorthand "acid rain," coined in the 1800s,[2] refers to wet and dry deposition collectively.

The effects of acid rain vary depending upon where it lands. Deposition in water bodies—aquatic acidification—can affect the pH[3] of the water and affect its habitability for aquatic organisms. EPA's rulemaking focused on these effects, rather than those of terrestrial acidification (deposits on land), because more and better data were available for aquatic ecosystems.[4] Final Rule, 77 Fed. Reg. at 20,242. Even so, the data, from many studies, indicated that the effects of acid rain on surface waters vary widely throughout the United States. *See id.* at 20,227.

Factors such as "biota, climate, geochemistry, and hydrology" have an impact. *Id.* at 20,229; *see also id.* at 20,225 (listing additional factors such as geology, topography, land use, and hydrologic flowpath). This short sentence, accurate as it is, masks an enormity of scientific complications because every

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[2] *See* Joseph Mac D. Schwartz, Comment, *On Doubting* Thomas*: Judicial Compulsion and Other Controls of Transboundary Acid Rain*, 2 AM. U. J. INT'L L. & POL'Y 361, 361 n.1 (1987).

[3] "The pH . . . of a solution is a measure of its acidity or alkalinity. A pH of 7.0 is neutral; a pH below 7.0 is acidic; and a pH above 7.0 is alkaline." *Warner-Jenkinson Co. v. Hilton Davis Chem. Co.*, 520 U.S. 17, 22 n.1 (1997). The scale is logarithmic: each whole number decrease signifies a ten-fold increase in acidity. *Id.*

[4] Although it is difficult to measure, terrestrial acidification affects the acidity of soil, which is correlated with "decreased growth and increased susceptibility to disease and injury" among red spruce and sugar maple trees. Final Rule, 77 Fed. Reg. at 20,226.

body of water is unique. How large and how deep is it? Is it a still lake or a flowing stream? And if it is a stream, is it a freestone stream slowly winding down from a mountain meadow, or does it move as rapidly as Niagara? What is the water body's mineral content, its vegetative content, its altitude, its temperature, its location?

"Parts of the West are naturally less sensitive to acidification," while other areas—for instance, "lakes in the Adirondacks and streams in Shenandoah National Park"—are considered "acid sensitive aquatic ecosytems." *Id.* at 20,236. In such "acid sensitive" waters, acid rain's effect on the water's pH can make the water uninhabitable for some fish and aquatic organisms. The disappearance of species can disrupt delicate food chains. *Id.* at 20,233. Less aquatic life may also mean less recreational fishing. *Id.*

In other areas, or in water bodies within the same area, acid rain may have no measurable effect.[5] *Id.* at 20,235. The limestone streams[6] of the Cumberland Valley of Pennsylvania

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[5] Because nitrogen fosters the growth of organisms, deposition can also cause "nutrient enrichment"—an alteration of the balance of available nutrients in a given ecosystem. Final Rule, 77 Fed. Reg. at 20,226-28. Despite its positive-sounding name, nutrient enrichment can lead to species death, foul odors, and outbreaks of harmful organisms. *See* MARK D. MUNN & PIXIE A. HAMILTON, U.S. GEOLOGICAL SURVEY, FS-118-03, NEW STUDIES INITIATED BY THE U.S. GEOLOGICAL SURVEY—EFFECTS OF NUTRIENT ENRICHMENT ON STREAM ECOSYSTEMS 2 (2003), *available at* http://pubs.usgs.gov/fs/fs11803/pdf/fs-118-03.pdf.

[6] "Limestone streams are different from most streams because of their unique composition and structure." Andrew H. Shaw, Comment, *The Public Trust Doctrine: Protector of Pennsylvania's Natural Resources?*, 9 DICK. J. ENVTL. L. & POL'Y 383, 384 (2000). For an in-

(Letort Spring Run, Falling Springs Run, Big Spring Creek)—the birthplace of modern American dry fly fishing—have produced stream-bred, trophy-size brown and rainbow trout for generations. *See generally* VINCENT C. MARINARO, A MODERN DRY-FLY CODE (1950). Because of their mineral content, these spring creeks—rich in aquatic vegetation (watercress, elodea grass) and insect life (mayflies, stoneflies, caddis, cress bugs)—are nature's antacid, quickly neutralizing whatever acidic compounds the rain may bring. *See,* Joe Kendall Neel, *Interrelations of Certain Physical and Chemical Features in a Headwater Limestone Stream*, 32 ECOLOGY 368, 386 (1951); *cf.* Final Rule, 77 Fed. Reg. at 20,235 ("[T]he same levels of deposition falling on limestone dominated soils have a very different effect from those falling on shallow glaciated soils underlain with granite."). The Firehole River in Yellowstone National Park provides another example, but a rather different one. The Firehole is a geothermal freestone stream rising out of the Park's geyser basins. Caldrons and mud pots and other thermal features along its banks emit vast quantities of sulphur gases as the stream winds its way to join the Gibbon River to form the Madison River. Along the Firehole the odor of rotten eggs (hydrogen sulfide) hangs in the air. Yet despite constant doses of these sulphur compounds, the Firehole River is one of the most productive trout streams in the world—and one of the most beautiful. *See generally Aquatic Ecology of Yellowstone*, NAT'L PARK SERV., http://www.nps.gov/yell/naturescience/fishing_ecology.htm (last visited May 2014).

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depth discussion of the chemistry of limestone streams, see Joe Kendall Neel, *Interrelations of Certain Physical and Chemical Features in a Headwater Limestone Stream*, 32 ECOLOGY 368 (1951).

B

The sources of atmospheric NO_y and SO_x are fairly well known. Small amounts of both types of oxides occur naturally. Volcanic eruptions and sea spray produce SO_x. *Causes of Acid Rain*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/region1/eco/acidrain/causes.html (last visited May 2014). Lightning strikes and rotting vegetation produce NO_y. *Id.* The largest sources of SO_x are "fossil fuel combustion at power plants (73%) and other industrial facilities (20%)." *Sulfur Dioxide*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/airquality/sulfurdioxide (last visited May 2014). The bulk of NO_y in the atmosphere also comes from the combustion of fossil fuels, mostly by motor vehicles and, to a lesser extent, from industrial operations. *Nitrogen Oxides*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/cgi-bin/broker?_service=data&_debug=0&_program=dataprog.national_1.sas&polchoice=NOX (last visited May 2014). With respect to ammonia, agriculture—particularly livestock operations—represents by far the largest source of emissions to the atmosphere, by one estimate 85 percent, although this estimate and others "are characterized by a high degree of uncertainty." COMM. ON ENV'T & NAT. RESOURCES AIR QUALITY RESEARCH SUBCOMM., NAT'L OCEANOGRAPHIC & ATMOSPHERIC ADMIN., ATMOSPHERIC AMMONIA: SOURCES & FATE 1 (2000), *available at* http://www.esrl.noaa.gov/csd/AQRS/reports/ammonia.pdf.

This explanation, too, overlooks many complexities. As explained, emitted oxides of nitrogen and sulfur cause the formation of acid rain which, in turn, causes both aquatic and terrestrial acidification. But acid rain is not the only or even the largest source of nitrogen's total environmental impact. Today,

the largest source of so-called "reactive nitrogen"[7] is agriculture—the manufacture and use of nitrogen-based fertilizers. ENVTL. PROT. AGENCY SCIENCE ADVISORY BD., REACTIVE NITROGEN IN THE UNITED STATES, at ES-4 (2011), *available at* http://yosemite.epa.gov/sab/sabproduct.nsf/WebBOARD/INCSupplemental. Agriculture is responsible for some NO_y emissions, *see id.* at 12 tbl.1, but, to a much greater extent, agriculture-related nitrogen compounds are surface-bound, affecting nearby land and water via leaching and runoff, *id.* at 15, 34; *see also id.* at 46 box 2 (estimating the varied impacts of N_r—from atmospheric, terrestrial, and water-based nitrogen—on the Chesapeake Bay watershed). Scientific uncertainty regarding all of the above chemical processes remains high. *Id.* at 33 finding 8.

II

A

EPA has been regulating NO_y and SO_x emissions, not together but separately, in a variety of ways since 1971, as required by the 1970 amendments to the Clean Air Act. *See* Pub. L. No. 91-604, 84 Stat. 1676. The Act established the regulatory structure still in force today.

Under the Act, EPA is required to regulate any airborne pollutant which, in the Administrator's judgment, "may reasonably be anticipated to endanger public health or welfare." 42 U.S.C. § 7408(a)(1)(A). For pollutants within that

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[7] Reactive nitrogen (N_r) is a broad term encompassing "all biologically active, chemically reactive, and radiatively active nitrogen compounds in the atmosphere and biosphere of the Earth." REACTIVE NITROGEN, *supra* note 1, at ES-1.

category—so-called "criteria air pollutants"[8]—EPA must promulgate national ambient air quality standards. *Id.* § 7409(a)(1)(A). Air quality standards are of two sorts. "Primary" national ambient air quality standards must be set at a level the attainment of which the EPA Administrator judges to be "requisite" to protect "the public health," *id.* § 7409(b)(1); "secondary" national ambient air quality standards must be set at a level the attainment of which is "requisite" to protect "the public welfare," *id*. § 7409(b)(2). The term "public welfare" "includes, but is not limited to, effects on soils, water, crops, vegetation, manmade materials, animals, wildlife, weather, visibility, and climate." *Id.* § 7602(h).

"At least every five years, EPA must reevaluate the standards and, if appropriate, revise them." *Cmties. for Better Env't v. EPA*, No. 11-1423, 2014 WL 1394655, at *1 (D.C. Cir. Apr. 11, 2014). The reevaluation requires EPA to undertake a "thorough review" of all primary and secondary standards and to "make such revisions in such criteria and standards and promulgate such new standards as may be appropriate in accordance with" § 7409(b). 42 U.S.C. § 7409(d)(1). Section 7409(b) is the provision requiring air quality standards to be set to protect the public health (primary standards) or welfare (secondary standards).

EPA's secondary national ambient air quality standards for sulfur and nitrogen oxides were initially set to protect against the harm to vegetation from direct exposure to those gases. The SO_x standard initially imposed both short term (three-hour

[8] There are currently six criteria air pollutants: carbon monoxide, lead, nitrogen oxides, ozone, particulate matter, and sulfur oxides. *Cmties. for Better Env't v. EPA*, No. 11-1423, 2014 WL 1394655, at *1 (D.C. Cir. Apr. 11, 2014).

average) and longer term (annual arithmetic mean) requirements.[9] The three-hour standard has remained in effect, but EPA revoked the annual standard in 1973 after this court remanded it to EPA for further explanation of its basis. *See Kennecott Copper Corp. v. EPA*, 462 F.2d 846 (D.C. Cir. 1972). The secondary standard for nitrogen oxides has remained essentially unchanged since its promulgation in 1971, and no area of the country has been found not to comply with it. *Nitrogen Dioxide*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/air/nitrogenoxides (last updated April 4, 2013).

The existing secondary standards do not account for the public welfare harms associated with acid rain. The issue, however, has not gone unaddressed. In 1990 Congress enacted, as Title IV of the Clean Air Act Amendments, an Acid Rain Program. *See* Pub. L. No. 101-549, tit. IV, 104 Stat. 2399 (codified at 42 U.S.C. §§ 7651 *et seq.*). Title IV created a "cap-and-trade program for sulfur dioxide ('SO_2') emitted by fossil fuel–fired combustion devices. Congress capped SO_2 emissions for affected units, . . . distributed 'allowances' among those units," and permitted the transfer of allowances among those units so as to keep total emissions beneath the cap. *North Carolina v. EPA*, 531 F.3d 896, 902 (D.C. Cir. 2008). The program also imposed "more traditional"—that is, non–market based—emissions limitations on NO_y emitters. U.S. ENVTL.

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[9] Every national ambient air quality standard includes an "averaging time," which specifies the duration over which compliance with the standard will be measured. *Am. Farm. Bureau Fed'n v. EPA*, 559 F.3d 512, 516 (D.C. Cir. 2009) (per curiam). A standard with a three-hour averaging time will be exceeded each time the average level of the pollutant over a three-hour span exceeds the standard. A standard employing an annual arithmetic mean allows more seasonal volatility: it measures compliance based on the pollutant's average level over the course of the year.

PROT. AGENCY, CLEARING THE AIR: THE FACTS ABOUT CAPPING AND TRADING EMISSIONS (2002) [CLEARING THE AIR], *available at* http://www.epa.gov/airmarkt/progsregs/arp/docs/clearingtheair.pdf; *see* 42 U.S.C. § 7651f.

Since 1980, the national average SO_2 concentration has dropped 78 percent. *Air Trends*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/air/airtrends/sulfur.html (last updated Sept. 3, 2013). This is the result, at least in part, of the cap-and-trade program established by the Acid Rain Program. *See* CLEARING THE AIR. The level of NO_y has also declined, but these reductions have been "offset by increases in emissions from automobiles." David B. Spence, *Coal-Fired Power in a Restructured Electricity Market*, 15 DUKE ENVTL. L. & POL'Y F. 187, 194 (2005).

B

EPA's current rulemaking proceeding, conducted pursuant to a consent decree,[10] began as a review of the existing secondary national ambient air quality standards for NO_y and SO_x pursuant to 42 U.S.C. § 7409(d). As mentioned earlier, the existing standards, issued in 1971, were not "directed toward depositional effects" on surface waters; both standards were

[10] The decree required EPA to issue a "decision" "concerning its review of the secondary NAAQS for NO_2 and SO_2" and to make "such revisions in the secondary NO_2 and SO_x NAAQS and/or promulgat[e] such new secondary standards for NO_x and SO_x as may be appropriate pursuant to 42 U.S.C. §§ 7408 and 7409(b)(2)." Second Stipulation to Amend Consent Decree at 2, *Ctr. for Biol. Diversity v. EPA*, No. 05-1814 (D.D.C. Oct. 22, 2009). As a result of the rulemaking now under review, the parties have jointly terminated the decree as having been complied with. Notice of Termination of Consent Decree, *Ctr. for Biol. Diversity v. EPA*, No. 05-1814 (D.D.C. Aug. 30, 2012).

designed "to protect against direct effects of gaseous oxides of nitrogen and sulfur" on plants—what biologists call "phytotoxic" effects. Final Rule, 77 Fed. Reg. at 20,239-40. In less scientific terms, the existing standards dealt with the vapors of these two compounds descending on plants and causing the plants to suffer stunted growth, or wilting, or death. Given the purpose of the existing secondary standards, there is general agreement they have done their job. *Id.* at 20,239.

As we have been explaining, however, direct exposure is not the only way in which these chemicals can cause harm. With respect to acid rain, EPA concluded—and all parties agree—that the existing secondary standards for NO_y and SO_x were "not adequate to protect against the adverse impacts of aquatic acidification on sensitive ecosystems." *Id.* at 20,236. Part of the problem is that the current NO_y and SO_x secondary standards did not, and were not designed to, "capture all relevant chemical species of oxides of nitrogen and sulphur that contribute to deposition-related effects." *Id.* at 20,234-35. The nitrogen standard is confined to nitrogen dioxide (NO_2) and the sulphur standard is confined to sulphur dioxide (SO_2). In addition, the current NO_2 and SO_2 standards measure exposure in terms of hours, a period that is not "relevant for ecosystem impacts . . . that occur over periods of months to years." *Id.* at 20,234. The current standards also did not take into account "variability in ecosystem sensitivity" to acid deposition. *Id.* at 20,235. "Ecosystems are not uniformly distributed either spatially or temporally in their sensitivity to oxides of nitrogen and sulphur." *Id.*

Once EPA found that the two current standards were inadequate with respect to acid rain, it sought to determine "what new multi-pollutant standard would be appropriate." *Id.* at 20,242. EPA recognized that such a national ambient air quality standard "would necessarily be more complex than the

NAAQS that have been set historically to address effects associated with ambient concentrations of a single pollutant." *Id.* And while the standard would be national in scope, EPA knew that the effects from acid rain vary throughout the country and that any new standard would have to reflect that variability. *Id.* To that end, EPA developed a "Policy Assessment" that divided the United States into 84 "ecoregions." *See* Office of Air Quality Planning & Standards, EPA, Policy Assessment for the Review of the Secondary National Ambient Air Quality Standards for Oxides of Nitrogen and Oxides of Sulphur (2011). Although acid sensitivity varies water-body-by-water-body, the ecoregions attempted to categorize certain areas, based on "a variety of vegetation, geological, and hydrological attributes that are directly relevant to aquatic acidification," as more or less sensitive. *Id.* at ES-7. The ecoregions, the Policy Assessment posited, would "allow for a practical application of an aquatic acidification standard on a national scale." *Id.*

To make this region-sensitive standard work, EPA developed what it called an "Aquatic Acidification Index." A relatively simple explanation of the Index is that it attempts to quantify the connection between the NO_y and SO_x in the air—the compounds EPA is authorized to regulate—and the expected harm from acid rain in any particular region. In a sensitive region, the Index would require more regulation of NO_y and SO_x; in a resilient region, it would require less. EPA expressed its Aquatic Acidification Index in the form of an equation, unnecessary to describe in this opinion.

"But, like any model, the Index may be scientifically sound in theory, or general concept yet, without the appropriate inputs, too uncertain to apply in practice." Br. for Resp'ts 3. The validity of the Index depends on its ability "to generate values that are representative throughout an entire ecosystem." *Id.* EPA ultimately concluded that those practical hurdles were too

high.[11] Citing doubts about the accuracy of the Aquatic Acidification Index, EPA decided not to promulgate a new, combined NO_y–SO_x secondary standard. It reasoned that limits on the accuracy of the Index's inputs prevented EPA from identifying with sufficient certainty a standard that would be, as the Clean Air Act requires, "requisite to protect the public welfare." 42 U.S.C. § 7409(b)(2). Instead EPA decided to "undertake a field pilot program to gather additional data." Final Rule, 77 Fed. Reg. at 20,263.[12] EPA also retained the individual NO_2 and SO_2 standards for the protection of vegetation, as its Scientific Advisory Committee recommended.[13]

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[11] The independent Clean Air Scientific Advisory Committee made a similar point: "It is difficult to judge the adequacy of the uncertainty analysis performed by EPA because of lack of details on data inputs and the methodology used, and lack of clarity in its presentation. . . . The parameters of the [Aquatic Acidification Index] are derived using air quality and aquatic models. Given that these models are being used in the standard setting process, a more rigorous model evaluation should have been conducted to provide more confidence in the use of the models." Letter from Drs. Armistead Russell & Jonathan M. Samet, Chairs, Clean Air Scientific Advisory Comm., to Lisa P. Jackson, Administrator, EPA (May 17, 2011), at encl. B, p. 11 [CASAC Report].

[12] The chief objective of the pilot program is to "enhance [EPA's] understanding of the degree of protectiveness that would likely be afforded by a standard based on the" Aquatic Acidification Index. Final Rule, 77 Fed. Reg. at 20,264. To further that objective, the program aims to evaluate the current methods for measuring NO_y and SO_x in the ambient air; better understand the "concentration and deposition patterns" of the compounds; collect further data for all the elements of the Aquatic Acidification Index formula; and further develop EPA's air monitoring network. *Id.*

[13] "The current public-welfare-based (secondary) NAAQS standards for oxides of nitrogen (NO_x) and sulphur oxides (SO_x) were

The issue in this petition for judicial review is whether EPA's decision to defer adopting a new standard at this time, pending further scientific study, violated § 7409(d)(1).[14]

III

When EPA undertakes a review of a secondary national ambient air quality standard, § 7409(d)(1) requires EPA to revise the standard or issue a new one "as may be appropriate in accordance with" § 7409(b). Section 7409(b)(2) requires such a secondary standard to be at a level of air quality that, "in the judgment of the Administrator," "is requisite to protect the public welfare from any known or anticipated adverse effects" from the pollutant in the ambient air. The phrase "requisite to protect" means that a secondary standard must be neither higher nor lower than necessary. *Whitman v. Am. Trucking Ass'ns*, 531 U.S. 457, 473, 475-76 (2001).

As we have said, all parties agree that the two secondary standards for NO_2 and SO_2 are not adequate to protect against adverse effects on water bodies from acid rain. According to petitioners, it follows that the Clean Air Act required EPA to issue a new secondary standard that would provide sufficient

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designed to protect vegetation from exposures to injurious concentrations of gaseous NO_x and SO_x. This protection is a desirable goal and for that reason the [Scientific Advisory] Panel recommends that the current secondary NO_x and SO_x NAAQS standards should be retained." CASAC Report at 1.

[14] We do not consider the intervenors' argument that EPA lacked the statutory authority to set a national ambient air quality standard using the Aquatic Acidification Index. EPA ultimately decided *not* to set a new standard. Thus, the question whether an Aquatic Acidification Index–based standard would have been lawful is hypothetical. *See Golden v. Zwickler*, 394 U.S. 103, 108 (1969).

protection. EPA interprets the Act differently: if the Administrator cannot make a reasoned judgment that a proposed new standard would comply with § 7409(b)(2), then—in the language of § 7409(d)(1)—it cannot be "appropriate" for EPA to issue it.

Even if we had no obligation to defer to EPA's interpretation of the Clean Air Act—but of course we do, *see Chevron, U.S.A., Inc. v. Natural Res. Def. Council*, 467 U.S. 837, 842-43 (1984)—EPA has by far the better of the argument. When EPA selects a standard during a rulemaking, it must exercise "reasoned" decisionmaking. *Am. Farm Bureau Fed'n v. EPA*, 559 F.3d 512, 530 (D.C. Cir. 2009) (per curiam). If, as EPA found, the available information was insufficient to permit a reasoned judgment about whether any proposed standard would be "requisite to protect the public welfare," promulgating that standard would have been arbitrary and capricious. *See* 42 U.S.C. § 7607(d)(9); *Motor Vehicle Mfrs. Ass'n v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 43 (1983).[15] It is ridiculous to suppose that the Clean Air Act required EPA to promulgate a secondary standard that would immediately violate the Act. Yet that is where petitioners' arguments lead.

Petitioners dispute EPA's conclusion that it lacked sufficient scientific information to make a reasoned judgment, and they argue that, even if EPA was correct, it failed to provide an adequate explanation on that score. Decades of decisions in this court stand in the way of these arguments.

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[15] Just like the Administrative Procedure Act, § 7607(d)(9) authorizes a reviewing court to reverse "arbitrary" and "capricious" agency action. *Compare* 42 U.S.C. § 7607(d)(9), *with* 5 U.S.C. § 706(2)(A). We have held the two standards to be equivalent. *See West Virginia v. EPA*, 362 F.3d 861, 867 (D.C. Cir. 2004).

Consider this sample of circuit law:

> "We must look at the decision not as the chemist, biologist or statistician that we are qualified neither by training nor experience to be, but as a reviewing court exercising our narrowly defined duty of holding agencies to certain minimal standards of rationality."

Ethyl Corp. v. EPA, 541 F.2d 1, 24, 36 (D.C. Cir. 1976) (en banc) (citations and footnotes omitted);

> "[I]n an area characterized by scientific and technological uncertainty . . . this court must proceed with particular caution, avoiding all temptation to direct the agency in a choice between rational alternatives."

Envtl. Def. Fund v. Costle, 578 F.2d 337, 339 (D.C. Cir. 1978);

> "[When EPA decisons] turn on . . . predictions dealing with matters on the frontiers of scientific knowledge, we will demand adequate reasons and explanations, but not 'findings' of the sort familiar from the world of adjudication."

Amoco Oil Co. v. EPA, 501 F.2d 722, 741 (D.C. Cir. 1974);

> "Happily, it is not for the judicial branch to undertake comparative evaluations of conflicting scientific evidence. Our review aims only to discern whether the agency's evaluation was rational."

Natural Res. Def. Council v. EPA, 824 F.2d 1211, 1216 (D.C. Cir. 1987);

> "[P]articular deference is given by the court to an agency with regard to scientific matters in its area of technical expertise . . .."

Nat'l Wildlife Fed'n v. EPA, 286 F.3d 554, 560 (D.C. Cir. 2002);

> "[C]ourts give a high level of deference to an agency's evaluations of scientific data within its area of expertise."

A.L. Pharma, Inc. v. Shalala, 62 F.3d 1484, 1490 (D.C. Cir. 1995);

> "In conducting this review, we show considerable deference, especially where the agency's decision rests on an evaluation of complex scientific data within the agency's technical expertise . . .."

Troy Corp. v. Browner, 120 F.3d 277, 283 (D.C. Cir. 1997);

> "[W]e will give an extreme degree of deference to the agency when it 'is evaluating scientific data within its technical expertise.'"

Hüls Am. Inc. v. Browner, 83 F.3d 445, 452 (D.C. Cir. 1996) (quoting *Int'l Fabricare Inst. v. EPA*, 972 F.3d 384, 389 (D.C. Cir. 1992)).

In its explanation in the Federal Register, and in its Policy Assessment, EPA explained in great detail the uncertainties it faced in seeking to set a secondary standard to protect against aquatic acidification. The problems, EPA thought, were not so much in the "conceptual formulation" of the theory embodied in the Aquatic Acidification Index. Final Rule, 77 Fed. Reg. at

20,249. But as EPA knew, the true test of a theory is whether it will work in practice. And EPA thoroughly explained why it believed that the "much higher uncertainties" surrounding "the specific elements within the structure of an [Aquatic Acidification Index–based] standard" were prohibitive. *Id.* at 20,249.

For example, as we mentioned earlier, although dry deposition may contribute as much as 60 percent of acidic deposits, it has not been adequately measured, due in large part to the "lack of efficient measurement technologies." *Id.* As to nitrogen, "although ambient measurements of NO_y are made as part of a national monitoring network, the monitors are not located in locations that have been determined to be representative of sensitive aquatic ecosystems or individual ecoregions." *Id.* at 20,261. Field measurements of NH_x (ammonia and ammonium), released from agriculture operations, were also "extremely limited." *Id.* at 20,249 n.12. In addition, EPA recognized "the inherent complexity of characterizing NH_x with respect to source emissions and dry deposition." *Id.* at 20,249. These and other "gaps in field measurement data increase uncertainties in modeled processes and in the specific application of such models," such as the Aquatic Acidification Index, to the 84 ecoregions EPA identified. *Id.* at 20,250.

Another large, unsolved problem relating to the Aquatic Acidification Index deals with what EPA designated as the "Acid Neutralizing Capacity" level, an "ecological indicator" used in its modeling. *Id.* at 20,255.[16] We have mentioned the

[16] The Index-based standard would have calculated the Acid Neutralizing Capacity for a given water body using what EPA termed that water body's "critical load." Final Rule, 77 Fed. Reg. at 20,230, 20,240, 20,245-46. In this context, a water body's "critical load" is

example of the limestone streams of the Cumberland Valley of Pennsylvania, which have the ability to neutralize acidic deposits. That example, and several others, demonstrate what EPA knew to be true: both within and among EPA's 84 ecoregions, the water bodies in the lower 48 states vary widely in their Acid Neutralizing Capacities. EPA did not attempt the monumental task of a stream-by-stream, lake-by-lake, river-by-river, estuary-by-estuary analysis for the United States. Instead it sought to estimate an acid neutralizing figure for each of the 84 ecoregions and to plug that figure into the Aquatic Acidification Index formula. But, as EPA explained, those region-wide estimates were based on very little data. "[T]here is," for example, "relatively sparse coverage in mountainous western areas where a number of sensitive aquatic ecosystems are located." *Id.* at 20,261. And even "in areas where relevant data are available, small sample sizes in some areas impede efforts to characterize the representativeness of the available data at an ecoregion scale." *Id.*

What we have described thus far is but a fraction of the analysis and explanation EPA provided in support of its decision not to establish a new multi-pollutant national ambient air quality standard without further studies. Citing these and many other problems, EPA concluded that "given the current high degree of uncertainties and the large complexities inherent in quantifying the elements of" the Aquatic Acidification Index, it had "no reasoned way to choose" a nationwide Acid Neutralizing Capacity or to apply the Index to each of the ecoregions throughout the country. *Id.* In light of the deference due EPA's scientific judgment, it is clear that its judgment must be sustained here.

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the highest load of acidic compounds it can absorb before chemical changes leading to long-term adverse effects are caused.

IV

We will end with a few words about *Massachusetts v. EPA*, 549 U.S. 497 (2007). There the Supreme Court held that an agency's decision not to promulgate a new rule "must conform to the authorizing statute." *Id.* at 533. We think it important to explain why, despite that decision, the Clean Air Act authorizes EPA to take the course it chose here.

As part of its review of the existing standards, EPA was obligated to promulgate a revision "as appropriate" under § 7409(b). EPA, exercising its authority to interpret ambiguous provisions of the Clean Air Act, determined that a revision was not "appropriate" when scientific uncertainty deprived the agency of a "reasoned way to choose" an appropriate standard. Final Rule, 77 Fed. Reg. at 20,252. Petitioners contend, citing a string of circuit precedent, that EPA's rationale violated the Clean Air Act because uncertainty is an illegitimate reason not to regulate under the Act. We have held that the Clean Air Act "demand[s] regulatory action to prevent harm, even if the regulator is less than certain that harm is otherwise inevitable" because "[a]waiting certainty will often allow for only reactive, and not preventive, regulation." *Ethyl Corp.*, 541 F.2d at 25; *see also Coal. for Responsible Regulation, Inc. v. EPA*, 684 F.3d 102, 122 (D.C. Cir. 2012); *Lead Indus. Ass'n v. EPA*, 647 F.2d 1130, 1155 (D.C. Cir. 1980). Petitioners therefore argue that despite the uncertainty, EPA violated the statute "by simply leaving in place" a standard it knew to be inadequate. Br. for Pet'r 29-30. We disagree.

First, EPA did not "simply leav[e] in place" the old standard. Although it did not promulgate a new standard, it identified the data gaps that prevented it from doing so and initiated a data-collection program designed precisely to fill those gaps and facilitate future regulation. *See* Final Rule, 77

Fed. Reg. at 20,264-67. EPA has not argued, and we do not hold, that after finding its existing standards inadequate, EPA was at liberty simply to leave them in place and take no action at all. And as we recently explained in *WildEarth Guardians v. EPA*, *Massachusetts* subjects "the manner, *timing*, content, and coordination" of EPA's rulemaking docket to very limited review. No. 13-1212, slip op. at 9 (D.C. Cir. May 13, 2014) (quoting *Massachusetts*, 549 U.S. at 533). By statute, EPA must address the "known or anticipated" harms associated with criteria air pollutants. 42 U.S.C. § 7409(b)(2). We cannot say, under deferential *Massachusetts* review, that targeted data collection is not a valid step toward that end.[17]

Second, the Clean Air Act's preference for preventive—and thus potentially speculative—regulation is not absolute. We explained that the Act proscribes "arbitrary" and "capricious" agency action, 42 U.S.C. § 7607(d)(9)(A), and that new rules must be based on reasoned judgment. *See State Farm*, 462 U.S. at 43. Reasoned judgment may at times permit—and the Act may at times require—action in the face of uncertainty, lest "the precautionary purpose of the statute" be undermined. *Ethyl Corp.*, 541 F.2d at 28. But, at some point, action infected by enough uncertainty cannot be called reasoned.[18] Distinguishing among these degrees is emphatically the province of EPA. *See* cases cited *supra*.

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[17] Even in *Massachusetts* itself, the Court, despite rejecting EPA's rationale for its decision not to regulate, "did not say that EPA was obliged to pursue rulemaking" on remand. *WildEarth Guardians*, No. 13-1212, slip. op. at 10; *see Massachusetts*, 549 U.S. at 533.

[18] In other words, the fact that we have rejected *certainty* as an appropriate goal, *see generally Ethyl Corp.*, 541 F.2d at 24-29, does not mean that regulation is required (or permitted) no matter how much *uncertainty* the agency faces.

Here, EPA explained at length that the uncertainty it faced was unusually profound. Across the Aquatic Acidification Index model, data gaps were "of such a significant nature and degree" that any rule promulgated would not have been based on "reasoned judgment." Final Rule, 77 Fed. Reg. at 20,256. Petitioners question that conclusion, but as between petitioners' critique and EPA's scientific analysis, EPA's judgment prevails. Because the Act requires a reasoned judgment, and because EPA found it could not form one, EPA's explanation "conform[ed] to the authorizing statute." *Massachusetts*, 549 U.S. at 533.

For all of these reasons, the petition for judicial review is denied.

So ordered.