ORAL ARGUMENT NOT YET SCHEDULED

No. 24-1120 (and consolidated cases)

UNITED STATES COURT OF APPEALS
FOR THE D.C. CIRCUIT

WEST VIRGINIA, et al.,

Petitioners,

v.

U.S. ENVIRONMENTAL PROTECTION AGENCY, et al.,

Respondents.

On Petitions for Review of a Final Agency Action of the U.S. Environmental Protection Agency, 89 Fed. Reg. 39,798 (May 9, 2024).

BRIEF FOR AMICUS CURIAE PROFESSOR RACHEL ROTHSCHILD IN SUPPORT OF RESPONDENTS

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October 18, 2024

CERTIFICATE AS TO PARTIES, RULINGS, AND RELATED CASES

Pursuant to D.C. Circuit Rule 28(a)(1)(A), amicus curiae Rachel Rothschild submits this certificate as to parties, rulings, and related cases.

A. Parties and Amici

All parties, intervenors, and amici appearing in this Court are listed in the Brief for Petitioners and the Initial Brief of the Federal Respondents.

B. Rulings Under Review

References to the agency action under review appear in the Brief for Petitioners.

C. Related Cases

There are no related cases within the meaning of Circuit Rule 28(a)(1)(C).

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D.C. CIRCUIT RULE 29(d) STATEMENT

Counsel for amicus curiae Professor Rachel Rothschild certifies, pursuant to Circuit Rule 29(d), that this separate brief is necessary to provide the Court with Professor Rothschild's unique perspective and expertise. Professor Rothschild has studied and written on the history of the Clean Air Act and the development of pollution control technology, which is directly relevant to the agency action under review. Thus, it would not be practicable to file a joint brief.

Dated: October 18, 2024

/s/ Sommer H. Engels
Sommer H. Engels

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STATEMENT OF INTEREST

Amicus Rachel Rothschild, Assistant Professor at the University of Michigan Law School, is a scholar of environmental law, history, and policy. She holds a J.D. from New York University School of Law and a Ph.D. from Yale University's Program in the History of Science and Medicine. Professor Rothschild is the author of the book *Poisonous Skies: Acid Rain and the Globalization of Pollution* (2019), which extensively examines the history of pollution control technologies and their relationship to government regulation of sulfur dioxide—a harmful air pollutant that contributes to the formation of acid rain.

This brief draws on Professor Rothschild's historical and legal expertise to highlight the parallels between industry challenges to EPA's performance standards for sulfur dioxide emissions in the 1970s and this challenge to EPA's performance standards for greenhouse gas emissions from power plants. Petitioners' arguments were legally and factually meritless in the 1970s, and the same is true today.[1]

SUMMARY OF ARGUMENT

Petitioners and their amici urge the Court to adopt a crabbed and regressive reading of the term "adequately demonstrated" and to second-guess EPA's technical

[1] No party nor party's counsel authored this brief in whole or in part, and no party nor party's counsel, nor any other individual or organization, contributed money that was intended to fund preparation or submission of this brief. This brief is filed with a motion to participate as amicus, in compliance with Federal Rule of Appellate Procedure 29(a)(3).

judgments regarding the deployment of carbon capture and sequestration technology (CCS). Per Petitioners, only technologies currently in consistent and full-scale commercial use can fairly be called "adequately demonstrated," and even evidence-based conclusions about their deployment must be dismissed as mere "forward-looking, Pollyanna optimism," Opening Brief of Petitioners at 48.

These arguments may sound familiar. Decades ago, industry made similar arguments in two cases challenging power plant emission standards based on flue gas desulfurization technology, or sulfur dioxide "scrubbers." Then, as now, regulated parties and their amici attempted to turn a statutory term that grants EPA space to make technical judgments into a narrow box-checking exercise focused on commercial prevalence. Coal companies and electric utilities asserted that scrubber technology was not sufficiently developed, had not yet been deployed at scale, and was too unreliable for the Administrator to call it "adequately demonstrated."

But this Court held in both cases that EPA had appropriately evaluated the technology's readiness to serve as the basis for emission standards and had made reasonable calculations about its development and deployment. And EPA's expert judgments were borne out. Scrubber technologies were successfully deployed, improving air quality and reducing acid rain—a pollution problem with numerous parallels to climate change. Today, industry touts the adoption of the technology, but

the historical record shows that EPA's standards provided the push necessary to implement it at scale.

Here too, EPA's record shows that it has drawn sensible conclusions about the feasible deployment of a scrubber technology—this time, CCS—and reasonably set standards based on its use. Petitioners object, but their arguments have been rejected twice before and should be rejected once again. Moreover, the rule at issue here is not based on forward-looking projections about a technology's future development. This time, the rule under review reflects EPA's expert determination that CCS is *already* capable of achieving the mandated reductions and ready for deployment at scale. In that regard, the technical evidence in the record before the Court far surpasses the scientific research on scrubbers that existed in the 1970s. Given the strength of EPA's current record and the agency's careful analysis, the pending petitions should be denied.

ARGUMENT

I. The arguments Petitioners advance here have been raised and rejected before.

A. EPA's 1971 new source standards.

In 1971, EPA listed fossil fuel-fired power plants as a source category and promptly set new source performance standards. 36 Fed. Reg. 5,931 (Mar. 31, 1971) (identifying category); 36 Fed. Reg. 24,876, 24,879 (Dec. 23, 1971) (setting standards). The standards, which required the plants to remove 70 to 75% of the

sulfur dioxide in their emission streams, reflected EPA's selection of large-scale flue gas scrubbers as the best system of emission reduction. 37 Fed. Reg. 5,767, 5,768 (Mar. 21, 1972) (EPA statement supplementing December 1971 standards).

Sulfur scrubbers remove sulfur dioxide pollution as power-plant emissions pass through chimneys. *Poisonous Skies* at 63. In the early 1970s, scrubber technology showed considerable promise in controlling sulfur dioxide but had not yet been widely adopted. *See id.* at 62–63, 67–68. In fact, only three U.S. facilities had even tried to operate scrubbers, and no U.S. facilities had achieved the reductions the 1971 standards eventually required. 37 Fed. Reg. at 5,768; *see* EPA Hearing Panel, *Report: National Public Hearings on Power Plant Compliance with Sulfur Oxide Air Pollution Regulations* 88–89 (Jan. 1974).[2]

EPA was optimistic, but other federal offices and agencies were skeptical. A few months before EPA finalized the 1971 standards, for example, the White House Council on Environmental Quality noted that "[t]echnology to control sulfur oxides and nitrogen oxides emissions is not yet commercially proven." Comments of the Edison Electric Institute on the Standards of Performance for New Stationary Sources (June 1972), in Appendix to the Briefs at 129, *Appalachian Power Company v. EPA*.[3] The Federal Power Commission similarly acknowledged that

[2] https://purl.fdlp.gov/GPO/gpo220517.

[3] Additional information about the archival sources cited in this brief is available in the attached addendum.

"commercially proven" flue gas desulfurization did not yet exist. Letter from John Tillinghast, Executive Vice President, American Electric Power, to Mr. [Donald] Goodwin, Office of Air Programs, EPA (Oct. 4, 1971), in Appendix to the Briefs at 163, *Appalachian Power Company v. EPA*.

Sulfur scrubber technology also faced headwinds because of industry opposition. For years, the power industry had been reluctant to fund the development of scrubbers without some indication that the government would require their use. *Poisonous Skies* at 65–68. Scrubber technology was expensive; EPA anticipated increases of 10% in capital costs and 7 to 30% in operating costs from the 1971 rule. EPA, Technical Report No. 1—Steam Generators, Background Information for Proposed New Source Performance Standards, August 1971 (Office of Air Programs Technical Report No. APTD-0711), in Addendum to Brief for Amicus Curiae at 23, Long Island Lighting Company et al., *Essex Chem. Corp. v. Ruckelshaus*.

In fact, rather than invest in the technology, the U.S. coal industry paid for studies intended to show that sulfur dioxide was not a serious health or environmental threat. *Poisonous Skies* at 68. They continued to do so even after new research indicated that sulfur dioxide could be causing both acidic rainfall and poor air quality. *Id.* During the 1970s, the U.S. coal industry spent ten times as much money on atmospheric and ecological studies of acid rain as it spent investing in the development of flue gas desulfurization. *Id.* at 61.

But EPA recognized that sulfur scrubber technology had potential, and it reasonably determined that the benefits of scrubber technology justified the cost. 37 Fed. Reg. at 5,768–70. EPA grounded its determination in scientific research and consultations with plant operators and designers. *See id*. Even though only three commercial scrubber units were in operation at the time, 13 companies had contracted for the construction of 17 scrubbing units, with more to follow. *Id.* at 5,768. One scrubber installation was "guaranteed by the designer to achieve 90 percent or better [sulfur dioxide] removal," and four others were "guaranteed at 80 percent or better." *Id.* EPA also recognized that sulfur dioxide scrubbers had been used successfully abroad. *Id.* at 5,768–69. Although EPA acknowledged that scrubbers sometimes experienced technical glitches, it found that mitigation strategies were available. *Id.* at 5,769.

Industry challenged the 1971 rule, asserting that sulfur scrubber technology was not developed enough to serve as the "best system of emission reduction." *Essex Chem. Corp. v. Ruckelshaus*, 486 F.2d 427, 433 (D.C. Cir. 1973). In their view, only technology that was "already introduced" and operating widely was "adequately demonstrated." Reply Brief for Petitioners at 24, *Essex Chem. Corp. v. Ruckelshaus*. At the very least, they argued, the technologies had to have operated "for at least one to two years under normal conditions." Brief for Petitioners at 21, *Essex Chem.*

Corp. v. Ruckelshaus [hereinafter "*Essex* Brief for Petitioners"] (emphasis removed).

The industry groups also attacked the scientific and technical evidence in the rulemaking record. *Essex* Brief for Petitioners at 20. They asserted that the tests EPA relied on were non-representative or otherwise conducted in unrealistic circumstances. *Id.* at 20–27 (noting that some referenced facilities were not operating at full capacity during testing). Other plants that were operating at full capacity allegedly failed to meet the prescribed standards. *Id.* at 24. The groups further criticized EPA's reliance on scientific literature to support the standards. *Id.* at 32–34.

Finally, the groups faulted EPA for failing to examine the challenges associated with the disposal of scrubber "sludge"—the waste substance produced during the scrubbing process. *Id.* at 46. In the early 1970s, U.S. facilities had almost no experience treating or disposing of sludge but knew that simply discharging it into waterways untreated could harm aquatic life and pose unknown dangers to human health. *Id.* Industry groups asserted that EPA ignored this reality when it promulgated the standards. *Id*. In response, EPA explained that it was "fully aware of the results of using a scrubbing system" and had concluded "that the problems associated with the system could be solved." Brief for Respondent at 18, *Essex Chem. Corp. v. Ruckelshaus*. EPA elaborated that if the waste proved unmanageable,

then industry had "the option of not building a new plant or of finding other solutions to the problem." *Id.* at 18–19.

In the end, the D.C. Circuit upheld the Administrator's determination that scrubber technology had been "adequately demonstrated." *Essex Chem.*, 486 F.2d at 433, 440. Recognizing that EPA's standards are subject to a "test of reasonableness," *id.* at 433–34, the Court concluded that the scientific evidence before the agency—including "tests of prototype and full-scale control systems, considerations of available fuel supplies, literature sources, and documentation of manufacturer guarantees and expectations"—supported EPA's determination, *id.* at 440. The statutory phrase "adequately demonstrated," the Court reasoned, does not require the agency to show the technology was operating perfectly, or even close to it. *Id.* Instead, EPA could rely on scientific literature and prototype testing data to make projections about the technology's deployment in the coming years. *Id.*

B. Technological development following the 1971 standards.

Initially, industry groups continued to resist the adoption of scrubber technologies even after final promulgation of the 1971 standards. In 1973, for example, utility representatives testified to Congress that "scrubber technology was unproved, unreliable, and ineffective." H.R. Rep. No. 95-294, at 89 (1977). A year later, one of the largest electric utilities took out full-page newspaper ads besmirching the technology and claiming it did not "exist in a practical working

sense." *See, e.g.*, American Electric Power System, *Are We Blind to the Real Energy Crisis?*, N.Y. Times, Apr. 30, 1974, at C59. Even if the technology was ready to go, they said, it could not be installed in time to meet air quality goals. *Id.* And even if it could be installed in time, its use would yield harmful byproducts. *Id.*

Despite this resistance, scrubber technology continued to develop and scrubber systems proliferated after the 1971 standards went into effect. Margaret R. Taylor et al., *Regulation as the Mother of Innovation: The Case of SO2 Control*, 27 Law & Pol'y 348, 371 (2005). Between 1974 and 1977, the number of scrubber systems in operation increased from 19 to 29. PEDCo. Env't, Inc., *Technical Report: Flue Gas Desulfurization System Capabilities for Coal-Fired Steam Generators*, Vol. I, 5 (Mar. 1978) [hereinafter "1978 Technical Report"].[4] By the end of 1978, 46 units were in operation, with approximately 100 more under construction or planned. PEDCo. Env't, Inc., *Technical Report: Electric Utility Steam Generating Units—Flue Gas Desulfurization Capabilities as of October 1978*, 1–3 (Jan. 1979).[5] Early attempts to place the technology into commercial operation faced some hurdles, but there was a "rapid advance in the understanding and application of

[4] https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=9101EJ8Z.TXT

[5] https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=91010NIP.TXT

scrubbing technology." Nat'l Acad. of Scis. et al., *Air Quality and Stationary Source Emission Control*, Sen. Serial No. 94-4, xxxi, 386–94 (Mar. 1975).[6]

These technological improvements can be linked directly to the 1971 standards. Empirical research has documented a surge in innovation that coincided with their promulgation. *See, e.g.*, Margaret R. Taylor et al., *Effect of Government Actions on Technological Innovation for SO_2 Control*, 37 Env't Sci. & Tech. 4527, 4530 (2003). The results suggest that "adoption of stringent national regulations for [sulfur dioxide] emissions control stimulated inventive activity more than government-sponsored research support alone" because the 1971 standards finally "established a national market" for scrubber technology, thereby further incentivizing its development. *Id.*

That forward progress prompted some of the "formerly unremitting critics of the scrubber technology" to change their view. H.R. Rep. No. 95-294, at 90. At a 1975 congressional hearing, a representative for the Edison Electric Institute admitted, in a complete about-face, that "[a]t some plants scrubbers just might be the best means available" to meet air quality standards. *Id.* at 89; *cf. Part 2, Clean Air Act Oversight: Hearings Before the Subcomm. on Pub. Health & Env't of the Comm. on Interstate & Foreign Com.*, 93d Cong. 944–45 (1973) (prior statement from Edison Electric expressing grave doubts about scrubbers). Costs also

[6] https://nap.nationalacademies.org/read/10840/chapter/1

plummeted as more facilities deployed the technology, and its use helped revitalize local economies dependent on power plants that used high-sulfur coal. George Getschow, *Coal Cleanup*, Wall St. J., Jun. 14, 1977, at 1.

Still, struggles remained. A segment of the coal industry continued to resist investments in scrubber technology, citing expense. Ben A. Franklin, *Coal's Time of Frustration: "Double Talk" Charged Coal's Frustration With U.S. Policies Facing Court Deadline*, N.Y. Times, May 5, 1979, at 29. Some utilities seemed to be "marking time" in the hope that EPA would not tighten standards any further. *Id.*; *see also Poisonous Skies* at 67–68. Rather than install pollution control devices, for example, some power plants built taller smokestacks to disperse sulfur dioxide higher into the atmosphere. While tall stacks could improve local air quality, they contributed to transboundary dispersal of sulfur dioxide pollution and worsened acid rain along the eastern United States. *Poisonous Skies* at 10, 16, 58–59.

Sludge disposal also continued to pose "a significant technological, environmental, and transportation problem." William Ellison & Edward Shapiro, *By-Product-Utilization/Ultimate-Disposal of Gas Cleaning Wastes from Coal-Fired Power Generation*, *in* Proceedings: Symposium on Flue Gas Desulfurization - Las Vegas, Nevada, March 1979; Volume II, 1187, 1187 (1979).[7] EPA itself

[7] https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=9100BOKP.txt

acknowledged that waste management was "the one big problem remaining" in deploying scrubber technology because sludge required "a large area for disposal." EPA, *Comparison of Flue Gas Desulfurization, Coal Liquefaction, and Coal Gasification for Use at Coal-Fired Power Plants* 28–29 (Apr. 1975).[8] Utilities echoed this concern. One coal plant claimed it would need "five 30-ton trucks operating around the clock" to deal with the sludge. Milton Jacques, *West Penn Power Co. Pushes Tall Stacks*, Pittsburgh Post-Gazette, Oct. 19, 1973, at 2.

Subsequent efforts by both EPA and industry to address this issue ultimately proved fruitful. EPA investigated multiple options for sludge treatment and disposal, and in the decade following promulgation of the 1971 rule, options and availability increased dramatically. EPA, *The Cost of Alternative Flue Gas Desulfurization (FGD) Sludge Disposal Regulations* 32–35 (Nov. 1980) (explaining that sludge management technologies "found steadily increasing application" following promulgation of the 1971 rule).[9] Scientists found, for example, that adding a particular chemical to the sludge improved "handling characteristics and disposal properties," allowing the modified sludge to be stored in a permanent pond, temporary pond, or landfill. *Id.* at 32. As scrubber technology improved over time, the sludge residue changed in form and could be disposed of more easily. *Id.* at 34;

[8] https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=91009MGB.txt

[9] https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=94007TW3.txt

see Larry Parker, Cong. Rsch. Serv., *Acid Rain Control: An Analysis of Title IV of S. 1630*, 43 (1990). In this way, too, promulgation of the 1971 standards spurred technological progress.

The history of scrubber development during this period is not unique. As scholars have noted, automobile emission control technologies also presented "major technical and economic challenges" to car manufacturers in the 1970s. *See* David Gerard & Lester Lave, *Implementing Technology-Forcing Policies: The 1970 Clean Air Act Amendments and the Introduction of Advanced Automotive Emissions Controls in the United States*, 72 Tech. Forecasting & Soc. Change 761, 762–63 (2005). Despite these significant hurdles, EPA's vehicle performance standards led to the creation of two innovative emission control devices after decades of stagnation in innovation and industry resistance. *Id.*

C. EPA's 1979 new source standards.

EPA further tightened sulfur dioxide emission standards in 1979 in response to growing scientific evidence about the pollutant's effects on public health and the environment. 44 Fed. Reg. 33,580, 33,581 (June 11, 1979). By this time, widespread scientific research documented how long-range atmospheric transport of sulfur dioxide caused acid rain, underscoring that use of tall stacks to address air pollution problems was a poor strategy. H.R. Rep. No. 95-294, at 85–86. Given the importance of incentivizing control measures that would reduce sulfur dioxide rather than

simply send it elsewhere, EPA's 1979 standards were designed to be "stringent in order to force the development of improved technology." 44 Fed. Reg. at 33,582.

The 1979 regulation was called "perhaps the most significant single rule-making action" the federal government had yet taken to reduce air pollution. Charles Mohr, *Billions at Stake as U.S. Weighs Clean-Air Rules*, N.Y. Times, Aug. 2, 1978, at A1. The updated standard, which required a 90% reduction in sulfur dioxide for plants using high-sulfur coal, was based on the use of advanced scrubbers together with other technological innovations like coal-washing. 44 Fed. Reg. at 33,582, 33,595.

At the time, the scrubber systems in use were designed to meet lower reduction rates, so EPA was unable to rely on experiments from current facilities to conclude that the standard was adequately demonstrated. 1978 Technical Report at 9. Only one commercially operating U.S. plant even came close to achieving the 90% reduction standard, and it malfunctioned for most of EPA's six-month test period. 44 Fed. Reg. at 33,592. Thus, EPA extrapolated from data generated in short-term pilot or prototype facilities to identify an appropriate standard. *Id.*; 1978 Technical Report at 9.

As before, industry balked. The President of the National Coal Association publicly warned that if EPA's regulation went into effect, the country would be forced to "kiss off coal." Ben A. Franklin, *Coal Outlook Troubled Despite High*

Hopes, N.Y. Times, Nov. 16, 1980, at 64. Utilities and the National Coal Association sued, contending that EPA's projections about the achievability of the new standard were arbitrary because the agency could cite no data showing that the required reductions were "actually achieved on a continuous basis by any currently operating" system. *Sierra Club v. Costle*, 657 F.2d 298, 360 (D.C. Cir. 1981).

Industry once again argued that EPA had misconstrued the meaning of "adequately demonstrated" and that the data underlying the Administrator's determination was inadequate. Just as occurred following the 1971 rule, they attempted to convince the Court that the EPA Administrator could deem only technology in widespread commercial use "adequately demonstrated." Initial Comments Submitted by the United Air Regulatory Group, Dec. 15, 1978, *Sierra Club v. Costle*, Joint Appendix Volume III at 3,331–32 [hereinafter "UARG Comments"].

The groups likewise claimed that EPA's expert conclusions were "based on nothing more than a 'hunch.'" Reply Brief for Petitioners at 31, *Sierra Club v. Costle*. They argued that EPA's extrapolations were unreasonable, UARG Comments at 3,593, and they urged the court to require EPA to conduct a more "detailed investigation" into the design and operating parameters of foreign flue gas desulfurization technologies before the agency could use them "as a design basis" for similar systems in the United States, *id.* at 3,798.

This time, industry's concerns had the backing of the Department of Energy. As EPA developed the 1979 standards, the Department told EPA officials that they strongly disagreed with EPA's "prediction" that scrubbers would "perform reliably" at the new level by the proposed 1983 compliance deadline. Letter from John F. O'Leary, Department of Energy Deputy Secretary, to Douglas M. Costle, EPA Administrator, July 6, 1978, *Sierra Club v. Costle*, Joint Appendix Volume III at 3,424; *see also* Resources for the Future, *The Great Scrubber Controversy*, 48 Resources 1, 16 (Jan. 1975) (recognizing that EPA faced resistance from sister agencies during this period).[10]

But this Court once again agreed with EPA. It rejected any suggestion that the Administrator could deem adequately demonstrated only those technological controls that have been "demonstrated over the long term by currently operating [plants]." *Costle*, 657 F.2d at 364. Instead, the Court reasoned, the Act gives EPA "authority to hold the industry to a standard of improved design and operational advances" as long as EPA reasonably determines that the "improvements are feasible and will produce the improved performance necessary to meet the standard." *Id.* After all, "the Clean Air Act is a technology-forcing statute." *Id.*

The Court also acknowledged the significance of the 1979 regulation, recognizing that coal was the "dominant fuel used for generating electricity in the

[10] https://media.rff.org/documents/Resources-magazine-issue-48.pdf

United States," and that industry would likely need to spend "tens of billions of dollars" over the next decade and a half to meet the standards. *Id.* at 313–14. But the "magnitude of the environmental and health interests" was also significant. *Id.* In the end, the Court's careful review of EPA's record revealed that EPA had "plotted a reasonable course through the evidentiary thicket and stated a logical rationale for the route it chose." *Costle*, 657 F.2d at 360. Although only "one commercial scale plant and one small pilot unit" could "almost but not quite meet the standard," the Court found that EPA made a reasonable judgment about the technology's future performance based on the record before it. *Id.* at 363–64.

The Court's analysis also reflected a proper understanding of its role. The case, the Court recognized, highlighted "the critical responsibilities Congress has entrusted to the courts in proceedings of such length, complexity and disorder." *Id.* at 410. In such fact-bound situations, the court's proper role on "close questions" is to give EPA "the benefit of the doubt out of deference for the terrible complexity of its job." *Id.*; *see id.* ("We are not engineers, computer modelers, economists or statisticians, although many of the documents in this record require such expertise and more."). Because EPA's technical judgments found sufficient support in the record, the Court determined they should be upheld.

D. Technological development following the 1979 standards.

Like the 1971 standards, the 1979 standards also preceded a surge in technological innovation that improved scrubber operations, efficiency, and cost—just as EPA had projected. *See* Taylor, *Regulation as the Mother of Invention*, *supra*, at 366–69; *see also* 44 Fed. Reg. at 33,582–83. To meet the new limits on sulfur dioxide emissions, industry invested more in scrubber development, in contrast to its dominant approach during the 1970s. Edward S. Rubin et al., *Experience Curves for Power Plant Emission Control Technology*, 2 Int. J. Energy Tech. & Pol'y 52, 61 (2004). As use expanded, scrubber technology became more effective and costs continued to fall. Taylor, *Regulation as the Mother of Invention*, *supra*, at 367.

By the end of the 1980s, when Congress passed the 1990 Clean Air Act Amendments to address acid rain explicitly, the power industry was well positioned to substantially lower sulfur dioxide emissions. *Poisonous Skies* at 180. Improved scrubber technologies allowed facilities to capture more than 90% of sulfur dioxide emissions, surpassing the 1979 rule's requirements. R. K. Srivastava & W. Jozewicz, *Flue Gas Desulfurization: The State of the Art*, 51 J. Air & Waste Mmgt. Ass'n 1676, 1683 (2001). That figure rose to nearly 100% by the early 2000s. *Id.* Developers of scrubber technology also succeeded in reducing the volume of sludge produced and pioneering new methods of waste recycling, rendering waste management a lesser hurdle than industry had feared. Parker, *supra*, at 43.

The emission reductions mandated in the 1990 Clean Air Act Amendments benefitted from the technological improvements that followed the 1971 and 1979 standards. *Poisonous Skies* at 188. EPA originally expected that the Amendments would cost about $10 billion a year to implement, and industry estimates were far higher. *Id.* Instead, the mandated reductions cost industry only a small fraction of that amount and yielded $10 billion a year in health and environmental benefits. *Id.* Several factors contributed to the reduced economic burden, but lower-than-anticipated gas scrubber prices played a substantial role. *Id.* The 1971 and 1979 regulations were thus crucial in positioning the United States to address the acid rain problem meaningfully and cost-effectively.

II. EPA's current standards are based on more robust research and technical demonstrations than prior Section 111 standards.

The arguments advanced in the pending petitions bear a striking similarity to those advanced in challenges to EPA's 1971 and 1979 sulfur dioxide standards. Once again, Petitioners express concern that CCS is simply not developed or reliable enough to be considered the best system of emission reduction, and they attempt to undermine EPA's record supporting its determination to the contrary. *See, e.g.*, Opening Brief for Petitioners at 48–49; *supra* pp. 6–7, 14–15.

As before, these arguments are unfounded. Indeed, the record under review is even more developed than the records supporting EPA's 1971 and 1979 standards. Unlike the scrubber technology EPA evaluated in the 1970s, CCS technology is

already achieving the mandated 90% capture rate and targeting reductions well above that rate. 89 Fed. Reg. 39,798, 39,813, 39,853–54 (May 9, 2024). Thus, EPA is no longer relying on pilots, prototypes, or forward-leaning projections. *Id.* at 39,830 & n.202; *see* Brief for Respondents at 25 (confirming that *Costle* and similar precedents are "not relevant" for that reason). This time, EPA has based its standards on much more data and research than existed for scrubber technology in the 1970s, and the Rule reflects its expert judgment that 90% CCS is already technically proven and available for deployment.

A. The Rule is grounded in data from existing CCS systems.

EPA's determination that 90% CCS is adequately demonstrated finds support in the agency's record, which includes not only higher-quality data but far more data than was available before promulgation of the 1971 and 1979 standards. While EPA's sulfur dioxide standards were based on projected technological advancements, the Rule under review is grounded in data collected from existing facilities.

For example, EPA's record includes data from several large-scale CCS facilities on coal-fired plants that have each operated CCS systems for years. *See* EPA, EPA-HQ-OAR-2023-0072-9095, Greenhouse Gas Mitigation Measures for Steam Generating Units Technical Support Document at 25 (2024) [hereinafter "Greenhouse Gas SGU Technical Support Document"]. One plant, SaskPower's

Boundary Dam Unit 3, which began operating in 2014, demonstrates that a CCS system can be successfully retrofitted onto an existing coal plant. 89 Fed. Reg. at 39,847. Boundary Dam's CCS system transports captured carbon via pipeline, stores it underground, and is designed to capture 90% of its carbon emissions. *Id.* Between 2017 and 2022, the system consistently captured more than 90% of the carbon dioxide in the slipstream routed through it. *Id.* at 38,848; *see also* Brief for Respondents at 32–33.

Another large-scale commercial facility EPA referenced, Petra Nova, began operating in 2017, temporarily paused operations in 2020 due to limited financial incentives, and recently restarted. 89 Fed. Reg. at 39,849–50. In its initial three years of operation, Petra Nova exceeded 90% carbon capture and sequestration from flue gas. *Id*. at 39,850. Despite several technical challenges, the plant was "never restricted in reaching its maximum capture rate." *Id.*; *see also* Brief for Respondents at 33–34.

Other plants EPA studied have achieved similar success. *See, e.g.*, 89 Fed. Reg. at 39,850; Brief for Respondents at 34–35. EPA likewise recognized that several CCS projects currently in development are targeting capture rates of at least 90%. 89 Fed. Reg. at 39,851. EPA also credited statements from CCS vendors that "attest" and "guarantee[]" that 90% capture rates are achievable. 89 Fed. Reg. at 39,850–52, 39,926–27; *see also* Brief for Respondents at 36 (discussing

performance guarantees offered by manufacturers). Given this information, EPA reasonably determined that 90% CCS is already proven and available for deployment. 89 Fed. Reg. at 39,813.

In the 1970s, by contrast, *no* commercial facilities had met the mandated standards before the 1971 and 1979 rules were finalized. *See supra* Parts I.A and I.C. Thus, EPA had to make projections not only about the proliferation of scrubber technology, but about the technology's future development. As discussed above, data from only a few pilot and prototype facilities was available before those standards were set. *See* 37 Fed. Reg. at 5,768 (preamble to 1971 standards reviewing data from three scrubber units, none of which satisfied the new standard); 44 Fed. Reg. at 33,592 (preamble to 1979 standards reviewing pilot or prototype facilities). Still, the Court correctly upheld EPA's determination, concluding that EPA had drawn reasonable conclusions based on the information available to it. *Essex Chem.*, 486 F.2d at 433; *Costle*, 657 F.2d at 363–64. The Rule now under review stands on even firmer footing.

B. EPA's analysis appropriately reflects existing momentum and incentives.

Two other important factors distinguish the Rule from the 1971 and 1979 standards: existing support and momentum. As explained above in Parts I.B and I.D, the 1971 and 1979 standards themselves drove the investments and inventive activity that followed. Taylor, *Regulation as the Mother of Invention*, *supra*, at 366. Here,

however, those processes are already underway. The standards now under review reflect EPA's assessment of the "rapid pace" with which the power sector has changed in only a few decades, 89 Fed. Reg. at 39,816, and the support CCS technology already finds in both the private and public sectors, *id.* at 39,820, 39,933.

For example, EPA recognized that Congress itself signaled its support for CCS when it passed the Inflation Reduction Act and substantially increased federal tax credits for both carbon capture and sequestration. Greenhouse Gas SGU Technical Support Document at 31; *see* 26 U.S.C. § 45Q; *see also* Brief for Respondents at 36.

EPA likewise recognized that the Department of Energy has also allocated up to $92 million to carbon pipeline development and $2.25 billion for large-scale carbon storage projects, funded by the Infrastructure Investment and Jobs Act. Greenhouse Gas SGU Technical Support Document at 32. In fact, the Department of Energy has invested in the research and development of CCS technology since 1991. *See* U.S. Dep't of Energy, *Carbon Management Strategy* at 3, 8–22 (Oct. 2024).[11] In the 1970s, EPA's scrubber policies sometimes lacked support from fellow federal offices and agencies, *see supra* pp. 15–16; now, however, EPA has powerful allies.

[11] https://www.energy.gov/sites/default/files/2024-10/Carbon%20Management%20Strategy_10.10.24.pdf.

EPA further recognized that many states have also adopted decarbonization goals and tax and regulatory policies to spur the proliferation of CCS projects. 89 Fed. Reg. at 39,821. The agency explained that those financial incentives can substantially lower the long-term cost of implementing CCS. *See* Greenhouse Gas SGU Technical Support Document at 52–54; EPA, EPA-HQ-OAR-2023-0072-9099, Greenhouse Gas Mitigation Measures Carbon Capture and Storage for Combustion Turbines Technical Support Document at 14 (2024). Those policies, combined with federal tax incentives and technological advances, "mean that CCS can be deployed at scale today." 89 Fed. Reg. at 39,813–14, 39,818–21.

Finally, EPA recognized that the cost to implement CCS technology has fallen dramatically in recent years. A 2015 report and a 2022 report together estimated that the incremental levelized cost of CCS dropped from $74/MWh to $44/MWh. *Id.* at 39,882. As EPA put it, these "[l]ower costs are central for the EPA's determination that CCS is the [best system of emission reduction] for certain [plants]." *Id.* at 39,810. Thus, EPA's decision to look to CCS technology for the Rule reflects a marketplace that is already successful and rapidly adapting.

In this regard, the agency's expert judgments about the deployment of 90% CCS stand on much more robust scientific and technical evidence than EPA had about scrubber technology when setting the 1970 standards. Still, the core of the case remains the same. EPA has once again made reasonable judgments about the use

and deployment of a pollution control technology, and this Court should once again conclude that EPA has charted a reasonable course forward.

CONCLUSION

For these reasons, the petitions should be denied.

Respectfully submitted,

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ADDENDUM

The National Archives and Records Administration, Kansas City, Missouri

Document	NAID	Box Number
EPA, Technical Report No. 1—Steam Generators, Background Information for Proposed New Source Performance Standards, August 1971 (Office of Air Programs Technical Report No. APTD-0711), Addendum to Brief for Amicus Curiae, Long Island Lighting Company et al., *Essex Chem. Corp. v. Ruckelshaus*	NAID 1127547	Box 35
Brief for Petitioners, *Essex Chem. Corp. v. Ruckelshaus*	NAID 1127547	Box 35
Brief for Respondent, *Essex Chem. Corp. v. Ruckelshaus*	NAID 1127547	Box 35
Reply Brief for Petitioners, *Essex Chem. Corp. v. Ruckelshaus*	NAID 1127547	Box 35
Comments of the Edison Electric Institute on the Standards of Performance for New Stationary Sources (June 1972), in Appendix to the Briefs, *Appalachian Power Company v. EPA*	NAID 1127547	Box 36
Letter from John Tillinghast, Executive Vice President, American Electric Power, to Mr. [Donald] Goodwin, Office of Air Programs, EPA (Oct. 4, 1971), in Appendix to the Briefs, *Appalachian Power Company v. EPA*	NAID 1127547	Box 36
Reply Brief for Petitioners, *Sierra Club v. Costle*	NAID 1127547	Box 38

Letter from John F. O'Leary, Department of Energy Deputy Secretary, to Douglas M. Costle, EPA Administrator, July 6, 1978, Joint Appendix Volume III, *Sierra Club v. Costle*	NAID 1127547	Box 39
Initial Comments Submitted by the United Air Regulatory Group, Dec. 15, 1978, Joint Appendix Volume III, *Sierra Club v. Costle*	NAID 1127547	Box 39

CERTIFICATE OF COMPLIANCE

This brief complies with the word limitation of Federal Rules of Appellate Procedure 29(a)(5) and 32(a)(7)(B). The brief contains 5,436 words, excluding the portions exempted by Federal Rule of Appellate Procedure 32(f) and D.C. Circuit Rule 32(e)(1).

This brief complies with the typeface requirements of Federal Rule of Appellate Procedure 32(a)(5) and the typestyle requirements of Federal Rule of Appellate Procedure 32(a)(6). The brief has been prepared in proportionally spaced typeface using Microsoft Word and 14-point Times New Roman font.

Dated: October 18, 2024

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I hereby certify that on October 18, 2024, a copy of the foregoing document was served on all registered counsel through the D.C. Circuit's CM/ECF system.

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