

United States Court of Appeals

FOR THE DISTRICT OF COLUMBIA CIRCUIT

Argued October 6, 1997 Decided February 13, 1998

No. 96-1497

APPALACHIAN POWER COMPANY, ET AL.,
PETITIONERS

v.

ENVIRONMENTAL PROTECTION AGENCY,
RESPONDENT

PUBLIC SERVICE ELECTRIC & GAS COMPANY, ET AL.,
INTERVENORS

Consolidated with
No. 97-1091

On Petitions for Review of an Order of the
Environmental Protection Agency

F. William Brownell argued the cause for petitioners
Appalachian Power Company, *et al.*, with whom *Henry V.*
Nickel and *Craig S. Harrison* were on the briefs.

Thomas Sayre Llewellyn argued the cause for petitioner Arizona Public Service Company, with whom *George Y. Sugiyama* and *Michael B. Wood* were on the briefs. *Munford P. Hall II* entered an appearance.

Scott J. Jordan and *Wendy L. Blake*, Attorneys, United States Department of Justice, argued the cause for respondent, with whom *Lois J. Schiffer*, Assistant Attorney General, and *Dwight C. Alpern*, Attorney, Environmental Protection Agency, were on the brief.

Richard E. Ayres, *John H. Sharp*, and *John H. Cheatham III* were on the brief for intervenor Natural Gas Supply Association, *et al.*

Harold P. Quinn, Jr., was on the brief for intervenor National Mining Association.

Andrew J. Gershon and *J. Jared Snyder*, Assistant Attorneys General, State of New York, *Brian J. Comerford*, Assistant Attorney General, State of Connecticut, *Edward G. Bohlen*, Assistant Attorney General, Commonwealth of Massachusetts, *Jeffrey A. Meyers*, Assistant Attorney General, State of New Hampshire, and *David Rocchio*, Assistant Attorney General, State of Vermont, were on the brief for *amici curiae* New York, Connecticut, Massachusetts, New Hampshire, and Vermont. *Lisa M. Burianek*, Assistant Attorney General, State of New York, entered an appearance.

Before: WALD, HENDERSON, and GARLAND, *Circuit Judges*.

Opinion for the Court filed *PER CURIAM*.

*PER CURIAM*¹: This case revisits Title IV of the Clean Air Act ("the Act"), which, *inter alia*, directs the Environmental Protection Agency ("EPA") to promulgate limits on the emission of nitrogen oxides from various electric utility boilers. In *Alabama Power Co. v. EPA*, 40 F.3d 450 (D.C. Cir. 1994), we invalidated the first set of these emission limits as exceeding EPA's statutory authority.² We are now presented with a challenge by a number of electric utilities and industry groups³ to the next group of nitrogen oxides emission limits promulgated under the Act: a more stringent revision of the first set of emission limits and a new set of emission limits for a second group of boilers. This time, we uphold the bulk of the challenged rule, concluding that EPA has not exceeded its authority and cognizant of the deference due to an agency dealing with largely scientific and technical matters. We vacate, however, the portion of the final rule that reclassifies certain retrofitted cell burner boilers as wall-fired boilers and remand it to EPA for reconsideration or a more adequate justification.

I. BACKGROUND

Among the 1990 amendments to the Clean Air Act, 42 U.S.C. § 7401 *et seq.* (1994), was Title IV, which was designed to reduce the adverse effects of acid deposition (more commonly known as "acid rain") from the atmosphere by limiting the allowable emissions of sulfur dioxide (SO₂) and nitrogen oxides (NO_x), two principal sources of acidic compounds. *See* 42 U.S.C. § 7651 (1994) (congressional findings and purposes). Electric utilities such as Appalachian Power contribute to NO_x emissions through the burning of coal, which

¹ Judge Wald authored the Introduction and Parts I, II.A, II.C, and III. Judge Garland authored Parts II.B and II.D.

² EPA subsequently repromulgated these limits in accordance with our opinion. *See* Acid Rain Program; Nitrogen Oxides Emission Reduction Program, 60 Fed. Reg. 18,751 (1995).

³ Because the named petitioner on this appeal is Appalachian Power Company, we refer to the petitioners as a group—except for Arizona Public Service Company, which has appealed separately—as "Appalachian Power."

releases nitric oxide (NO) that reacts with elements in the air to form nitrogen dioxide (NO₂) and other harmful pollutants. In 1990, electric utility emissions constituted approximately 32 percent of total annual NO_x emissions. *See* Acid Rain Program; Nitrogen Oxides Emission Reduction Program, 61 Fed. Reg. 67,112, 67,112 (1996). In order to encourage a reduction in NO_x emissions, Title IV directs EPA to set NO_x emission limits for two groups of coal-fired electric utility boilers and divides those boilers into two additional groups for the purpose of setting compliance deadlines. A boiler therefore may be a "Group 1 boiler"⁴ or a "Group 2 boiler,"⁵ depending on its type, and may be a "Phase I boiler" or a "Phase II boiler," depending on when it is subject to emissions limitations.⁶ There are both Group 1 boilers and Group 2 boilers in each of the compliance phases.

⁴ Group 1 comprises tangentially fired boilers and dry bottom wall-fired boilers other than those applying cell burner technology. *See* 42 U.S.C. § 7651f(b)(1) (1994). A tangentially fired boiler's burners are located in the corner of the furnace, while a wall-fired boiler's burners are located along the furnace wall. *Alabama Power*, 40 F.3d at 452 n.1.

⁵ Group 2 comprises wet bottom wall-fired boilers, cyclone boilers, cell burners, and "all other types of utility boilers." *See* 42 U.S.C. § 7651f(b)(2) (1994). Wet bottom boilers are characterized by a high internal temperature that converts ash into molten slag, which collects in a tank at the bottom of the furnace. Cyclone boilers are a type of wet bottom boiler in which the fuel and air are burned in horizontal, water-cooled cylinders called "cyclones." Cell burners are dry bottom boilers that have arrays of two or three closely spaced circular burners, forming a "cell," mounted on the wall of the furnace. Vertically fired boilers contain conventional circular burners or coal and air pipes oriented downward rather than horizontally, as in wall-fired boilers. Acid Rain Program; Nitrogen Oxides Emission Reduction Program, 61 Fed. Reg. 1442, 1456 (proposed Jan. 19, 1996).

⁶ The terms are derived from the statutory scheme regarding limits on SO₂ emissions. *See* 42 U.S.C. § 7651f(a) (1994). In this scheme, boilers subject to the limitations in Phase I, *see* 42 U.S.C. § 7651c (1994), must comply with the limits by January 1, 1995; boilers subject to the limitations in Phase II, *see* 42 U.S.C. § 7651d

One method of reducing NO_x emissions is to retrofit coal-fired boilers with an emission control device. For Group 1 boilers, such a device commonly consists of what is termed "low NO_x burner technology," which, as we noted in *Alabama Power*, is an emission control method that limits the amount of oxygen available to react with the nitrogen in the coal and thus reduces the amount of nitrogen oxides formed. *Alabama Power*, 40 F.3d at 452 n.3. The emissions from Group 2 boilers are more difficult to reduce, and thus Group 2 boilers are retrofitted with a greater variety of emission controls, including selective catalytic reduction,⁷ selective non-catalytic reduction,⁸ gas reburning,⁹ and plug-in and non-plug-in retrofits.¹⁰ Each control method can achieve varying levels of NO_x emissions reduction.

As we noted in *Alabama Power*, Congress intended in enacting Title IV "to tie the obligation of utilities to meet the NO_x emission limit to the use of low NO_x burners." *Alabama Power*, 40 F.3d at 455. To this end, section 407(b)(1) requires that the Group 1 limits be set at a maximum of 0.45 pounds per million British thermal units ("lb/mmBtu") for tangential-

(1994), must comply by January 1, 2000. Failure to adhere to the prescribed limitations results in a fine. *See* 42 U.S.C. § 7651j(a) (1994).

⁷ Selective catalytic reduction involves adding ammonia to the flue gas of the burner, which then passes through a catalyst, turning the NO_x into molecular nitrogen and water. 61 Fed. Reg. at 1458.

⁸ Selective noncatalytic reduction injects a reducing agent into the flue gas that reacts with the NO_x in the gas to form molecular nitrogen and water. *Id.*

⁹ Gas reburning involves the diversion of part of the primary fuel heat input to a location above the main burners. As flue gas passes through this area, part of the NO_x formed is converted to molecular nitrogen. *Id.*

¹⁰ Installing non-plug-in combustion controls on cell burners involves replacing the portion of the wall containing the cell with a new wall containing widely spaced low NO_x burners. Plug-in controls, by contrast, replace the cells with low NO_x burners, maintaining the original cell configuration. *Id.* at 1457-58.

ly fired boilers and 0.50 lb/mmBtu for dry bottom wall-fired boilers, unless EPA finds that these rates cannot be achieved using "low NO_x burner technology," a term not explicitly defined in the statute. The limits, which were to be set by May 15, 1992, would then apply to Group 1, Phase I boilers starting on January 1, 1995. 42 U.S.C. § 7651f(b)(1). EPA was permitted to revise the Group 1 limits by January 1, 1997, to apply to Phase II boilers if it determined that "more effective low NO_x burner technology [was] available." 42 U.S.C. § 7651f(b)(2).¹¹ If no such revision were undertaken by January 1, 1997, the limits established for the Group 1, Phase I boilers were to go into effect for the Group 1, Phase II boilers. EPA was also required to set by January 1, 1997, the NO_x emission limits for Group 2 boilers. These limits were to be based "on the degree of reduction achievable through the retrofit application of the best system of continuous emission reduction, taking into account available technology, costs and energy and environmental impacts; and which is comparable to the costs of nitrogen oxide controls" set for the Group 1, Phase I boilers. 42 U.S.C. § 7651f(b)(2).

On March 22, 1994, well past its statutory deadline, EPA promulgated the Group 1, Phase I emission limits. *See Acid Rain Program; Nitrogen Oxides Emission Reduction Program*, 59 Fed. Reg. 13,538 (1994). The final rule defined "low NO_x burner technology" to include overfire air, another emission control method, as well as low NO_x burners themselves.¹² We invalidated the rule as inconsistent with EPA's statutory directive, holding that the term "low NO_x burner technology"

¹¹ The statute provides that boilers subject to the Phase I emission limits set pursuant to section 407(b)(1) of the Act will not be subject to any revised limits. *See* 42 U.S.C. § 7651f(b)(2).

¹² Like low NO_x burners, overfire air, as we noted in *Alabama Power*, reduces the amount of oxygen available to react with the nitrogen in the coal and thus limits the formation of NO_x. It accomplishes this by removing oxygen from around the burner and reintroducing it to the boiler through a port above the burner. *Alabama Power*, 40 F.3d at 452 n.3.

was an "unambiguous reference to low NO_x burners" that did not permit EPA to include additional control methods. *Alabama Power*, 40 F.3d at 455. EPA subsequently revised the 1994 regulations on April 13, 1995, to eliminate references to overfire air and established limits of 0.45 lb/mmBtu for tangentially fired boilers and 0.50 lb/mmBtu for wall-fired boilers, limits identical to those provided for in the statute. *See* 60 Fed. Reg. at 18,763; 42 U.S.C. § 7651f(b)(1). To account for the delay in promulgation, the compliance date for Group 1, Phase I boilers was moved to January 1, 1996. 60 Fed. Reg. at 18,763.

The rule at issue here, issued on December 19, 1996, promulgates the next set of emission limits under the statutory scheme: the revised NO_x emission limits for Group 1, Phase II boilers as well as the NO_x emission limits for Group 2 boilers. 61 Fed. Reg. at 67,112. EPA revised the Group 1 limits after determining, as required by section 407(b)(2), that boilers with low NO_x burners were achieving lower emission levels than the limits promulgated in 1995 and therefore that more effective low NO_x burner technology was available. (This determination was the result of a regression analysis in which EPA constructed equations capturing the reduction achieved by Group 1, Phase I boilers and applied these equations to the uncontrolled emission rates of Group 1, Phase II boilers.) In establishing the Group 2 emission limits, EPA interpreted its statutory directive to require a comparison of the cost-effectiveness of Group 2 controls and low NO_x burner technology and thus promulgated emission limits for Group 2 boilers based on control technologies that were shown to be as cost-effective in reducing NO_x emissions as low NO_x burner technology. In addition, relying on section 407(a), which states that a boiler becomes an "affected unit" for purposes of the NO_x emission limits at the same time it becomes an affected unit for purposes of the SO₂ emission limits (established elsewhere in Title IV), EPA set January 1, 2000, as the date by which compliance with the

new limits must be achieved.¹³ Finally, EPA determined that certain retrofitted cell burner boilers should be reclassified from Group 2 to Group 1, thereby subjecting them to the stricter emission limits applicable to the latter group.

Appalachian Power and petitioner Arizona Public Service Company now seek review of these portions of the final rule, claiming that EPA's actions both exceeded its statutory authority and were arbitrary and capricious.¹⁴

¹³ The emission limits established by the final rule were 0.40 lb/mmBtu for tangentially fired boilers; 0.46 lb/mmBtu for dry bottom boilers; 0.68 lb/mmBtu for cell burners; 0.86 lb/mmBtu for cyclones larger than 155 megawatts of electricity ("MWe"); 0.84 lb/mmBtu for wet bottom boilers larger than 65 MWe; and 0.80 lb/mmBtu for vertically fired boilers. EPA determined that each of these limits would be achievable by 85 to 90 percent of the applicable boiler population. 61 Fed. Reg. at 67,113-14.

¹⁴ Appalachian Power appended five exhibits to its reply brief that it asserts buttress arguments made in its opening brief. Four of the exhibits appear to consist of manipulations of EPA's statistical models prepared by Appalachian Power's consultant at least four months after the final rule was issued. Because these exhibits were never submitted to EPA, they are excluded from the record for judicial review. See 42 U.S.C. § 7607(d)(7)(A) (1994); *American Petroleum Inst. v. Costle*, 609 F.2d 20, 22 (D.C. Cir. 1979). Appalachian Power contends that the exhibits could not have been submitted during the rulemaking because EPA did not disclose its methodology early enough in the process. Even if this were true, under such circumstances the statute requires that the materials first be raised with the agency through a petition for reconsideration. See 42 U.S.C. § 7607(d)(7)(B) (1994); *American Petroleum Inst. v. Costle*, 665 F.2d 1176, 1191 (D.C. Cir. 1981) (quoting H.R. REP. NO. 95-294, at 323 (1977)) (" '[T]he Agency must first be given an opportunity to pass on the significance of the materials and determine whether supplementary proceeding[s] are called for or not.' "). The virtue of this requirement is readily apparent in this case: Because the four documents were appended to a reply brief with virtually no explication and without opportunity for agency response, we are unable to evaluate their accuracy or significance. A fifth document appended to Appalachian Power's reply brief is a Department of Energy memorandum commenting on a draft of

II. DISCUSSION

A. *The Group 1, Phase II Emission Limits*

Appalachian Power's first challenge is to EPA's statutory authority to revise the Group 1 emission limits, which is bounded by the requirement that the agency must determine that "more effective low NO_x burner technology is available." See 42 U.S.C. § 7651f(b)(2). EPA argues that a plain reading of this language reveals that it may revise the Group 1 emission limits if performance data show that *available* technology can achieve lower emission limits. It contends that because Congress required the agency to evaluate the capabilities of low NO_x burner technology when setting the initial Group 1 limits, Congress must have intended that EPA would reevaluate those capabilities in deciding whether to revise those limits. Appalachian Power argues, however, that "more effective" technology refers to a change in burner design and not merely to a proven increase in the effectiveness of existing burners. Because EPA has not provided evidence that "more effective" burners than those justifying the April 1995 limits exist, Appalachian Power argues, the revised rates must be vacated as contrary to the statute.

Because resolution of this question turns on the interpretation of the statutory phrase "more effective low NO_x burner technology," the two-step *Chevron* framework governs our analysis. Under *Chevron*, we must first consider, having studied the statutory text and the legislative history, "whether Congress has directly spoken to the precise question at issue. If the intent of Congress is clear, that is the end of the matter; for the court, as well as the agency, must give effect

EPA's final rule. As the statute makes clear, such interagency comments are not part of the record for judicial review. See 42 U.S.C. § 7607(d)(7)(A); *Sierra Club v. Costle*, 657 F.2d 298, 404 n.519 (D.C. Cir. 1981). Accordingly, we grant EPA's motion to strike the five exhibits.

Appalachian Power's challenge to the rule's NO_x allowance program, see 40 C.F.R. § 76.16 (1997), has been mooted by our granting of EPA's motion to vacate and remand this portion of the rule.

to the unambiguously expressed intent of Congress." *Chevron U.S.A. Inc. v. Natural Resources Defense Council, Inc.*, 467 U.S. 837, 842-43 (1984); *see also Ohio v. United States Dep't of the Interior*, 880 F.2d 432, 441 (D.C. Cir. 1989). If Congress has not directly addressed the precise question at issue, "the question for the court is whether the agency's answer is based on a permissible construction of the statute," *Chevron*, 467 U.S. at 843—that is, whether it is "reasonable in light of the Act's text, legislative history, and purpose." *Southern Calif. Edison Co. v. FERC*, 116 F.3d 507, 511 (D.C. Cir. 1997).

Chevron's first step does not take us very far. There is nothing in the statutory section at issue or in the legislative history to suggest what Congress meant by "more effective low NO_x burner technology" or, more specifically, whether the phrase can encompass varied applications of existing controls as well as new controls. The word "technology," for example, is a chameleon word, capable of many meanings, but here even its context does not help us to identify a precise meaning. Elsewhere in the Act, "technology" is defined as comprising "methods, systems, and techniques," which lends support to EPA's interpretation, *see, e.g.*, 42 U.S.C. § 7479(3) (1994) (defining "best available control technology" as an emission limitation achievable through "application of production processes and available methods, systems, and techniques"), but this single reference cannot suffice to determine Congress's intent with respect to low NO_x burners.

The legislative history also provides few clues as to the breadth of the phrase. Although the 1990 amendments to the Act were ultimately the product of a conference committee, the language in section 407(b)(2) was derived largely from the Senate bill. During debate on the bill, several senators referred to "low NO_x burner technology" as the standard by which other emission control methods would be judged, but none of these senators elaborated on what the phrase included. *See, e.g.*, 136 CONG. REC. 35,627 (1990) (statement of Sen. Cochran) ("[U]tilities will be allowed to comply with nitrogen oxide reduction requirements through the application of low-NO_x burner technology. This technology is a reasonable,

cost-effective method which has proven to be successful in achieving significant NO_x reductions."); 136 CONG. REC. 5046 (1990) (statement of Sen. Lott) (emission rates are based on "the application of low-NO_x burner technology, a much more reasonable and cost-effective method proven to successfully achieve significant NO_x reductions"). Similarly, the conference report accompanying the final version of the bill notes simply that "[t]he NO_x reductions from existing units mandated under section 407 are to be accomplished by use of conventional, available burner technology ('low-NO_x' burners)," H.R. CONF. REP. NO. 101-952, at 344 (1990), a declaration that does not aid us in divining whether the phrase "more effective low NO_x burner technology" implies a change in burner.

Because our search for Congress's intent has been less than fruitful, we go on to decide, under the second step of the *Chevron* analysis, whether EPA's interpretation of the phrase "more effective low NO_x burner technology" to encompass improved performance of existing burners is reasonable. We believe that it is. As we have noted, it is evident that Congress intended that low NO_x burner technology serve as a benchmark for emission limits promulgated under Title IV, so to the extent that the rule derived from EPA's interpretation does not require technology beyond low NO_x burners, that rule would not be inconsistent with the intent of the statute. EPA's interpretation is also consistent with the concern with achievability that motivates the section. *See, e.g.*, 42 U.S.C. § 7651f(b)(1) (EPA may set higher emission limits than those provided by statute if statutory rates are not achievable); *id.* § 7651f(b)(2) (Group 2 emission limits must be based on achievable degree of reduction). In other words, it is a fair interpretation to read Congress's directive that more effective technology be available as authorizing more stringent limits only if those limits are achievable in practice. Moreover, the fact that Congress did not simply require a determination that "more effective low NO_x burners" existed suggests that "more effective low NO_x burner *technology*" refers to something beyond the burner hardware itself. If this were not the case, we would expect to find some evidence to the contrary

in the legislative history; we find none, and Appalachian Power is unable to point us toward any.

We addressed a similar issue with respect to the Clean Air Act in *International Harvester Co. v. Ruckelshaus*, 478 F.2d 615 (D.C. Cir. 1973). At issue was a provision of the Act that authorized a one-year exemption from an emission-level requirement if, *inter alia*, "the applicant has established that effective control technology, processes, operating methods, or other alternatives are not available." *Id.* at 624 (quoting 42 U.S.C. § 1857f-1(b)(5)(D)(iii) (1970)). We rejected the petitioners' argument that EPA's determination of whether technology was "available" must be based solely on "technology in being as of the time of the application." Rather, we held that EPA was justified in determining what technology would be considered "available" based on predicted improvements in existing technology, "subject to the restraints of reasonableness." *Id.* at 628-29. *See also Portland Cement Ass'n v. Ruckelshaus*, 486 F.2d 375, 391-92 (D.C. Cir. 1973) (in determining "achievable" emission limits, EPA may make reasonable projection based on existing technology). We can find no significant difference between a determination that "available" technology includes predicted improvements in existing technology and a determination that "more effective" technology includes actual improved performance in existing technology. We thus think it reasonable, as a preliminary matter, for EPA to find that "more effective low NO_x burner technology" exists if improved performance for already-existing burners can be shown.

Appalachian Power next argues that even if "more effective low NO_x burner technology" is given the meaning we approve today, EPA has failed to show that boiler performance has improved. EPA asserts that its regression analysis shows that boilers retrofitted with low NO_x burners can achieve lower emission levels than the limits deemed adequate by the 1995 rule. This improvement in performance, EPA contends, may be attributable to a number of improvements in the effectiveness of the technology surrounding low NO_x burners, including the accumulated experience of boiler operators, improved operating practices, more advanced burner tuning

and management software, and improved automation. Appalachian Power challenges this conclusion, arguing that the revised limits set by the rule require technology beyond the capability of low NO_x burners. Because Appalachian Power's challenge, although framed in the most general of terms, is at root a challenge to EPA's analytical model, we must consider whether the use of that model was arbitrary and capricious. See 42 U.S.C. § 7607(d)(9) (1994) (authorizing reversal of actions under the Act found to be "arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law"). Our analysis is guided by the deference traditionally given to agency expertise, particularly when dealing with a statutory scheme as unwieldy and science-driven as the Clean Air Act. As we have previously noted, so long as EPA "acted within its delegated statutory authority, considered all of the relevant factors, and demonstrated a reasonable connection between the facts on the record and its decision," we will not interfere with its conclusion. *Ethyl Corp. v. EPA*, 51 F.3d 1053, 1064 (D.C. Cir. 1995).

Statistical analysis is perhaps the prime example of those areas of technical wilderness into which judicial expeditions are best limited to ascertaining the lay of the land. Although computer models are "a useful and often essential tool for performing the Herculean labors Congress imposed on EPA in the Clean Air Act," *Sierra Club*, 657 F.2d at 332, their scientific nature does not easily lend itself to judicial review. Our consideration of EPA's use of a regression analysis in this case must therefore comport with the deference traditionally given to an agency when reviewing a scientific analysis within its area of expertise without abdicating our duty to ensure that the application of this model was not arbitrary. As we have noted, it is only when the model bears no rational relationship to the characteristics of the data to which it is applied that we will hold that the use of the model was arbitrary and capricious. See *American Iron & Steel Inst. v. EPA*, 115 F.3d 979, 1005 (D.C. Cir. 1997); *Chemical Mfrs. Ass'n v. EPA*, 28 F.3d 1259, 1265 (D.C. Cir. 1994). Therefore, while we will examine each step of EPA's analysis to satisfy ourselves that the agency has not departed from a

rational course, we will not take it upon ourselves, as nonstatisticians, to perform our own statistical analysis—a job more properly left to the agency to which it was delegated.

EPA's determination of the revised Group 1 emission rates involved four steps: (1) the construction of a database consisting of Group 1, Phase I boilers already employing low NO_x burner technology; (2) the derivation of two equations (one each for tangentially fired boilers and wall-fired boilers) that captured the percent reduction in emissions from the uncontrolled emission rates achieved by the boilers in the database; (3) the application of these equations to the uncontrolled emission rates of Group 1, Phase II boilers; and (4) the setting of emission rates for Group 1, Phase II boilers based on the range of data resulting from the application of the equations. We examine each of these steps in turn.

1. *Construction of the Database*

EPA began its determination of whether the Group 1 limits should be revised by constructing a computerized database consisting of all known boilers that had installed only low NO_x burners¹⁵ subsequent to November 15, 1990 (the date the amendments to the Act were enacted),¹⁶ and for which there existed at least 52 days of data measured by continuous emission monitors ("CEMs").¹⁷ This database consisted ini-

¹⁵ Our ruling in *Alabama Power* prevented EPA from interpreting "low NO_x burner technology" as constituting any control method in addition to low NO_x burners.

¹⁶ EPA considered only post-1990 retrofits because it believed that Congress implicitly incorporated the then-current state of burner technology into the Act's amendments. *See* 61 Fed. Reg. at 1443. *Appalachian Power* does not challenge this conclusion.

¹⁷ A CEM is used "to sample, analyze, measure, and provide, by readings taken at least once every 15 minutes, a permanent record of emissions, expressed in pounds per hour (lb/hr) for sulfur dioxide and in pounds per million British thermal units (lb/mmBtu) for nitrogen oxides." 40 C.F.R. § 72.2 (1997). Both EPA and industry commenters believed that 52 days constituted the minimum number of days of data needed for a valid analysis. *See* 61 Fed. Reg. at 67,124.

tially of 24 wall-fired boilers and 9 tangentially fired boilers. 61 Fed. Reg. at 67,121. In response to the recommendations of several commenters that various boilers be included in or excluded from this database, EPA formalized and expanded its selection criteria into Data Quality Objectives ("DQOs")—"rigorous and precisely defined rule tables" used to select candidates for the database. *Id.* at 67,122. Application of the DQOs resulted in a new database consisting of 39 wall-fired boilers and 14 tangentially fired boilers, a result that EPA believed would "increase[] the overall representativeness of the database." *Id.* at 67,123-24.

EPA then considered the lowest average NO_x emission rate each boiler in the database had sustained for at least 52 days when CEM data were available (the "low NO_x period"). To take into account the fact that the emissions rate immediately after low NO_x burner installation might not be representative of a boiler's emissions rate at full operating capacity, EPA also analyzed emission rates for a time period beginning 30 days after resumption of operation after installation until the end of the available CEM data as well as for a time period beginning with the first hour of the low NO_x period until the end of the available CEM data. *Id.* at 67,125.¹⁸ In response to comments that suggested that the 52-day period alone was insufficient to determine actual emission rates, EPA selected for the final rule the time period beginning with the first hour of the low NO_x period until the end of the available CEM data (the "post-optimization period") as the basis for assessing low NO_x burner performance.¹⁹ *Id.* at 67,126.

¹⁸ EPA also developed "load-weighted annual average NO_x emission rates" to take into account the fact that the low NO_x period may not adequately capture seasonal variations in demand for power and found these rates to be "essentially the same as or lower than" the average emission rates for the low NO_x period. 61 Fed. Reg. at 67,125.

¹⁹ Appalachian Power's argument that EPA unreasonably limited its analysis to the 52-day period is thus unfounded. In any event, the use of the post-optimization period seems eminently rational

As part of its procedural challenge to the rule, Appalachian Power argues that EPA violated the rulemaking requirements of the Act by not disclosing the DQOs until the final rule, apparently invoking the Act's requirement that EPA's notice of proposed rulemaking ("NPRM") include, *inter alia*, "the methodology used in obtaining the data." 42 U.S.C. § 7607(d)(3)(B) (1994). We disagree. While it is true that the DQOs did not appear in the NPRM in precisely the same form or to the same extent as they did in the final rule, it is not the case that any significant DQO appeared for the first time in the final rule. In the NPRM, EPA listed two criteria that governed selection of boilers for the database: (1) whether units had installed only low NO_x burners and had installed them after the date of enactment of the 1990 amendments and (2) whether post-retrofit hourly emission rate data, measured by CEMs and sustained for at least a 52-day period, was available. 61 Fed. Reg. at 1443-44. The DQOs in the final rule include these criteria as well as the following: (1) the database would be limited to Group 1 boilers; (2) boilers for which low NO_x burner design, installation, and/or operations were known to be seriously flawed would be excluded; (3) boilers would have to have a pre-retrofit uncontrolled emission rate based on quality-assured data; (4) New Source Performance Standards boilers²⁰ or boilers using Powder River Basin coal would be excluded because they could more easily meet low NO_x emission limits than other boilers. 61 Fed. Reg. at 67,122 (Table 3). With the exception of criterion (1), which merely defines the database, the DQOs that appeared explicitly for the first time in the final rule were all intended to exclude faulty or overly optimistic data. Appala-

given the alternatives: Using solely the 52-day period would, as Appalachian Power argues, rely on too little data, and using the entire post-retrofit period after the 30-day break-in period would give inordinate weight to data arising from a time when a boiler was not operating at its optimal performance level.

²⁰ New Source Performance Standard boilers are new coal-fired utility boilers on which construction began after August 17, 1971, and which are subject to the New Source Performance Standards contained in 40 C.F.R. pt. 60. 61 Fed. Reg. at 67,121.

chian Power does not and, we think, could not contend that it would have challenged these quality-control DQOs had they been presented in full in the proposed rule. There is therefore no basis for us to conclude, as we must to invalidate the rule for procedural errors, that the addition of these DQOs in the final rule was "so serious and related to matters of such central relevance to the rule that there is a substantial likelihood that the rule would have been significantly changed if such errors had not been made." 42 U.S.C. § 7607(d)(8) (1994). By including all the database criteria in the NPRM that could possibly have been subject to adverse comment, EPA has complied with its statutory directive to include "the methodology used in obtaining the data."

Moreover, we can find no apparent defects in the database itself. In constructing the database for the final rule, EPA applied the DQOs not only to those boilers used in the proposed rule analysis but also to those boilers that commenters requested that EPA consider as well as to additional boilers identified by EPA as using low NO_x burner technology. This resulted in the addition of 20 boilers to the database (which ultimately contained a total of 39 wall-fired boilers and 14 tangentially fired boilers²¹). 61 Fed. Reg. at 67,123-24. In this respect, EPA has identified all likely candidates for the boiler database as well as been responsive to comments.²² Appalachian Power's assertion that the emission rates reflect

²¹ Although the relatively small number of tangentially fired boilers might be cause for looking more closely at the regression analysis for this subgroup, *see* Daniel L. Rubinfeld, *Reference Guide on Multiple Regression*, in REFERENCE MANUAL ON SCIENTIFIC EVIDENCE 415, 454 (1994) (noting that 30 data points are typically seen as sufficient for regressions with a small number of explanatory variables), Appalachian Power has not controverted EPA's assertion that the database is representative of the entire boiler population.

²² We therefore reject Appalachian Power's assertion that EPA's enlargement of the database post-proposal constituted a procedural violation. As we noted in *International Harvester*, 478 F.2d at 632 n.51, it would be unproductive to insist that an agency "learn from the comments on its proposals only at the peril of starting a new

boilers employing beyond-burner technology is not supported by the record.

2. Construction of the Equations

Using the database, EPA constructed two linear regression equations, one for wall-fired boilers and one for tangentially fired boilers, that captured the percent reduction in emissions with low NO_x burner technology as a function of the uncontrolled emission rate. As EPA noted in the preamble to the final rule, the use of a regression model rather than a simple extrapolation from the low NO_x burner database would enable EPA better to predict the effect of installing low NO_x burner technology on Phase II boilers. *See* 61 Fed. Reg. at 67,130.

It is commonly understood that the more variables that are included in a regression analysis, the more likely it is that the model describes accurately the phenomenon it is being used to explain.²³ As the Supreme Court has noted in the employment discrimination context, "the omission of variables from a regression analysis may render the analysis less probative than it otherwise might be," but it does not render the analysis completely devoid of value. *Bazemore v. Friday*, 478 U.S. 385, 400 (1986). Nevertheless, a number of commenters, Appalachian Power among them, argued that EPA's analysis failed to take into account several operational factors associated with low NO_x burners, including normal aging and wear of

procedural round of commentary." So long as the final rule promulgated by the agency is a "logical outgrowth" of the proposed rule—that is, if "the purposes of notice and comment have been adequately served," *Fertilizer Inst. v. EPA*, 935 F.2d 1303, 1311 (D.C. Cir. 1991)—we will find no procedural violation. EPA's action between proposal and promulgation, which served only to bolster the validity of the model by increasing the amount of data upon which it was based, certainly satisfies this standard.

²³ *Cf. National Lime Ass'n v. EPA*, 627 F.2d 416, 431 n.46 (D.C. Cir. 1980): "[T]o be achievable, we think a uniform standard must be capable of being met under most adverse conditions which can reasonably be expected to recur and which are not or cannot be taken into account in determining the 'costs' of compliance."

equipment, increased particulate emissions, auxiliary equipment design, and furnace configuration, all of which arguably could have an effect on the level of NO_x emissions. EPA responded to this concern by using the post-optimization period rather than the 52-day period for analysis, which it believed would "reasonably account for variation in operating conditions among Group 1 boilers." EPA Response to Comments at 63.²⁴ "The claim that there are various problems due to aging of equipment that have not yet been encountered," the agency continued, "is speculative and unsupported." *Id.*

While EPA's response could have been more extensive, it does not suggest that the agency's use of the regression models was arbitrary and capricious. As we have previously noted, the party challenging the use of such a model "cannot undermine a regression analysis simply by pointing to variables not taken into account that might conceivably have pulled the analysis's sting." *Koger v. Reno*, 98 F.3d 631, 637 (D.C. Cir. 1996) (dicta). *See also Segar v. Smith*, 738 F.2d 1249, 1277 (D.C. Cir. 1984) (noting that where there is no reason to conclude that the omitted variable correlates with the dependent variable, the omission will not affect the validity of the analysis). Rather, that party must identify clearly major variables the omission of which renders the analysis suspect. This conclusion, derived from employment discrimination cases, holds equally true in this context, even more so because of the deference due to an agency's scientific analysis. Neither the commenters before EPA nor Appalachian Power here before us has offered any data to support the assertion that additional factors not accounted for in EPA's regression analysis would have a significant effect on NO_x emissions. The regression equations were constructed based on the data available or reasonably predictable at the time of the final rule; to require EPA to take into account variables for which

²⁴ This document, containing EPA's responses to comments submitted during the rulemaking process, was incorporated by reference in the preamble to the final rule. *See* 61 Fed. Reg. at 67,120.

no data existed would be to require that it engage in precisely the type of arbitrary rulemaking the Act forbids.

3. Application of the Equations to the Uncontrolled Emission Rates of Phase II Boilers

The next step of EPA's analysis was to calculate, through the application of the regression equations developed to the uncontrolled rates of the Phase II boilers,²⁵ the NO_x emission rate each Phase II boiler could be expected to achieve through a low NO_x burner retrofit. Appalachian Power's primary challenge to this step of the analysis is that the results generated by the regression equation are faulty because they do not include the uncertainty inherent in the calculation—in other words, the true reduction in NO_x emissions associated with a particular retrofit might be somewhat greater than or less than the amount yielded by the regression equation. As a result, Appalachian Power contends, because EPA based its revised emission limits on what represents the midpoint between the uncertainty boundaries, the predicted emission levels are based on levels achievable by only 50 percent of the Phase II boilers.

Although Appalachian Power's assertion that the results are subject to some uncertainty is correct, we do not believe its complaint constitutes a telling critique of EPA's analysis. In any regression analysis, the line described by the regression equation represents the best possible fit to the data; some points will necessarily be plotted above the line and some will fall below the line (except in the rare circumstance in which the line is a perfect fit to the data). While each data point will be associated with some residual (the difference

²⁵ EPA noted in the preamble to the proposed rule that the Group 1, Phase II database of uncontrolled emission rates contained information for only 69 percent of the Phase II population. 61 Fed. Reg. at 1449. While a more complete database would have been preferable, EPA determined by comparison of boiler size and age that the Phase II database "adequately represents the entire Phase II population." *Id.* Appalachian Power has not suggested that this is not the case.

between actual and fitted values), so long as this residual is within acceptable statistical limits, the fact that some data points necessarily fall below the line does not render the regression analysis invalid. As we have noted in similar circumstances, "[t]hat the model does not fit every application perfectly is no criticism; a model is meant to simplify reality in order to make it tractable." *Chemical Mfrs.*, 28 F.3d at 1264. To invalidate a model simply because it does not perfectly fit every data point "would be to defeat the purpose of using a model." *Id.* at 1265. Appalachian Power does not suggest in its argument before us that the uncertainty surrounding the data points is statistically unacceptable, only that it exists.²⁶ We would not deem that sufficient to label EPA's model arbitrary and capricious.

This is not, certainly, like the case in *Sierra Club*, in which we rejected a 92 percent sulfur removal rate that was based solely on evidence that "only one commercial scale plant and one small pilot unit can almost but not quite meet the standard." 657 F.2d at 363. In this case, 23 of 39 wall-fired boilers and 9 of 14 tangentially fired boilers in Group 1, Phase I can currently meet the revised limits. 61 Fed. Reg. at 67,123-24 (Tables 4 and 5). Because the statute requires only a determination that more effective low NO_x burner technology is "available" for a class of boilers, the fact that, as

²⁶ One way to assess the "fit" of a particular model is by its R² value. R² is a measure of the percentage of variation in the dependent variable that is accounted for by the explanatory variables—here, the degree of reduction in emissions explained by the installation of low NO_x burners. The range of values for R² is between 0 and 1; the closer R² is to 1, the more the change in the dependent variable is explained by the explanatory variables. *Chemical Mfrs. Ass'n v. EPA*, 870 F.2d. 177, 215 n.139 (5th Cir. 1989). The R² value for the wall-fired boiler equation was 0.731, while the R² value for the tangentially fired boiler equation was 0.707. 61 Fed. Reg. at 67,133. While "[a]s a general rule, courts should be reluctant to rely solely on a statistic such as R² to choose one model over another," Rubinfeld, *supra*, at 457; *see also Segar*, 738 F.2d at 1282 n.27, it cannot be said from these values that

Appalachian Power claims, some individual boilers cannot currently meet the revised limits does not serve to invalidate the rule.

4. *Determination of the Limitation*

Finally, EPA used the rates resulting from the regression equations to determine "reasonably achievable emission limitation[s]" ²⁷ for Phase II boilers. 61 Fed. Reg. at 67,130. Appalachian Power asserts, however, that the predicted controlled emission rates of many boilers are so close to the emissions limits that any error in the prediction would render these boilers in violation of the limits. In addition, it claims that many utilities typically attempt to overcontrol emissions so that any fine tuning of the boiler will not bring the boiler over the emission limit. If the rule deems this "overcontrolled" emissions level achievable, Appalachian Power claims, utilities will be penalized for anticipating control difficulties. For both these reasons, Appalachian Power argues that EPA should have included a compliance margin in the NO_x emission limits.

Again, we find this challenge insufficient to vacate the rule. The first reason that this is so is a statutory one: The Act permits EPA to revise the emissions limitations upon a finding that "more effective low NO_x burner technology is available." 42 U.S.C. § 7651f(b)(2). The fact that these boilers can achieve lower emission levels with low NO_x burner technology—even if they depend on a cushion between those levels and the emissions limits—demonstrates that the statutory requirement has been satisfied. Moreover, as EPA has noted in the preamble to the final rule, boiler owners who fear that tuning may send them over the allowable limits may use the alternative emission limitations ("AEL") and averaging options provided in the Act to ensure that their total NO_x emissions from all affected units comply with EPA regula-

EPA's use of this statistical model represented unreasoned decisionmaking.

²⁷ EPA defined a "reasonably achievable" limit as one that could be met by 85 to 90 percent of the relevant boiler population. 61 Fed. Reg. at 67,136.

tions.²⁸ 61 Fed. Reg. at 67,136. Finally, we note, as EPA has pointed out, that the limit applies to a unit's average annual emission rate rather than to a monthly or a daily emission rate. This means that a boiler may overemit on some days and underemit on others and still be deemed in compliance with its emission limit. Given these various options, there is no reason that EPA's failure to build a compliance margin into the limits themselves should render them arbitrary and capricious. We therefore reject Appalachian Power's challenge on this front, as with its other substantive challenges to the Group 1, Phase II limits.

Undaunted, Appalachian Power and intervenor National Mining Association ("NMA") mount an additional procedural challenge to the Group 1, Phase II limits: namely, that EPA justified its revision of the rates based on public health and welfare concerns not authorized in the statute.²⁹ See 61 Fed. Reg. at 67,160-61. We do not find this argument persuasive. The statute provides that EPA "*may* revise" (emphasis added) the limitations if it determines that more effective technology is available. We have noted that when a statute uses the permissive "may" rather than the mandatory "shall," "this choice of language suggests that Congress intends to confer some discretion on the agency, and that courts should accordingly show *deference* to the agency's determination. However, such language does not mean the matter is *committed*

²⁸ Under the AEL provision, EPA may authorize an emission limitation less stringent than that promulgated if it determines that a particular boiler cannot meet the applicable limitation despite the installation and proper operation of the appropriate control technology. See 42 U.S.C. § 7651f(d) (1994). Under the emissions averaging provision, the owner or operator of two or more affected units may petition to have the emission rates for those units averaged in order to meet the emissions limit. See 42 U.S.C. § 7651f(e) (1994).

²⁹ In an attempt to present evidence of the ongoing debate over whether environmental concerns warrant more stringent limits, NMA appended several items to its brief that were not before EPA during the rulemaking process. Because these items are not part of the record on review, see 42 U.S.C. § 7607(d)(7)(A), we grant EPA's motion to strike the attachments.

exclusively to agency discretion." *Dickson v. Secretary of Defense*, 68 F.3d 1396, 1401 (D.C. Cir. 1995) (emphases in original). Here, it is clear that EPA's discretion is not boundless because section 407(b)(2) requires that EPA determine that more effective low NO_x burner technology is available before it is permitted to revise the Group 1 emission limits. There is no indication, however, that Congress intended to further limit EPA's discretion to revise the Group 1 limits once such a determination has been made. Our conclusion is supported by the fact that section 407(b)(2) provides that EPA "shall" establish the Group 2 emission limits by January 1, 1997, but "may" revise the Group 1 limits by the same date. *See* 42 U.S.C. § 7651f(b)(2). The use of both words in the same statutory subsection—as well as the section's further reference to the applicability of "the revised emission limitations, *if any*" (emphasis added)—implies that Congress intended that EPA's discretion to revise the Group 1 limits be broader than its discretion to set the Group 2 limits.

Ethyl Corp., relied on by Appalachian Power, is not to the contrary. In *Ethyl Corp.*, we considered a statute that provided that EPA, "upon application of any manufacturer of any fuel or fuel additive, may waive" a prohibition against introducing certain fuel additives into commerce upon a finding that "the fuel additive does not cause or contribute to a failure of vehicles to meet emission standards." 51 F.3d at 1055, 1058 (quoting 42 U.S.C. § 7545f(4) (1988 & Supp. V 1993)). The statute also provided that if EPA did not act either to grant or to deny a waiver application within 180 days, the waiver would be treated as granted. *See id.* at 1059 (quoting 42 U.S.C. § 7545(f)(4)) ("If the Administrator has not acted to grant or deny an application under this paragraph within one hundred and eighty days of receipt of such application, the waiver authorized by this paragraph shall be treated as granted."). EPA found that Ethyl had established the factual finding but denied its waiver application for public health reasons. We held that in the context of the entire statute, the statutory language stating that EPA "may waive" the prohibition after making the requisite factual determina-

tion referred to EPA's discretion "to either act affirmatively, granting or denying a waiver, or not to act, and instead, to let the 180-day limit run." *Id.* As a result, we held that once the factual standard was met, EPA's discretion extended only to the decision as to whether the waiver would occur through EPA's action or EPA's inaction. Here, by contrast, there is no statutory language that provides a more limited definition of the phrase "may revise." There is not, as in *Ethyl Corp.*, a provision that once the requisite factual finding is made, the Group 1 limits will be revised even if EPA chooses not to act affirmatively to do so. Section 407(b)(2) states simply that EPA "may revise" the Group 1 emission limits downward if it determines that more effective low NO_x burner technology is available, limited only by the provision that the new emission limits, "if any," will not apply to boilers already regulated in Phase I. Given the lack of alternative interpretations, we cannot conclude that the word "may" has the same effect as it did in *Ethyl Corp.*, that is, that it gives EPA discretion only to choose the avenue by which revised emission limits will be promulgated. Rather, we believe that "may revise" refers to EPA's discretion to revise the Group 1 limits at all even after the requisite finding on more effective low NO_x burner technology has been made. For EPA to justify this decision in part by referring to the environmental concerns of the Act, *see* 61 Fed. Reg. at 67,119-20; EPA Response to Comments at 281, was not arbitrary and capricious—indeed, it would have been arbitrary for EPA to offer no justification, and Appalachian Power has not suggested other considerations that would have been more consonant with the statutory framework.³⁰

³⁰ In fact, it is difficult to see how Appalachian Power has been injured by EPA's consideration of public health and welfare concerns. EPA referred to these factors only in determining whether it should, in its discretion, impose the limits that it had already determined were justified under the statutory criterion. If EPA had believed that it could not take these considerations into account, the result would have been identical: EPA would have imposed the same limits Appalachian Power now challenges.

In any event, it is clear, contrary to Appalachian Power's argument, that EPA has sufficiently justified its decision to revise the Group 1 emission limits apart from environmental concerns. Appalachian Power is correct that the burden is on EPA to justify the change from the 1995 emission limits, which the agency agreed were "aggressive," *see* 60 Fed. Reg. at 18,758-59, "[b]ut that justification need not consist of affirmative demonstration that the status quo is wrong; it may also consist of demonstration, on the basis of careful study, that there is no cause to believe that the status quo is right, so that the existing rule has no rational basis to support it." *Center for Auto Safety v. Peck*, 751 F.2d 1336, 1349 (D.C. Cir. 1985). As EPA has noted, the 1995 emission limits were based on data from periods only until 1992, while the current limits incorporated additional data from as recently as 1996. *See* 61 Fed. Reg. at 67,120; EPA Response to Comments at 27-28. This increase in available data, and the more stringent limits that analysis of that data generated, were sufficient for EPA to conclude that "there is no cause to believe that the status quo [*i.e.*, the 1995 emission limits] is right." Because we find nothing irrational in that determination, we uphold the revised Group 1 NO_x emission limits.

B. *The Group 2 Emission Limits*

By contrast to the boilers in Group 1, the boilers in Group 2 are not necessarily amenable to retrofitting with low NO_x burners. For this reason, Congress did not require EPA to base its Group 2 emission limits on that single control technology. Instead, in section 407(b)(2), Congress instructed EPA to base the Group 2 emission rates on

the degree of reduction achievable through the retrofit application of the best system of continuous emission reduction, taking into account available technology, costs and energy and environmental impacts; and which is comparable to the costs of nitrogen oxides controls set [for Group 1 boilers].

42 U.S.C. § 7651f(b)(2). Appalachian Power challenges EPA's interpretation of this statutory language, an interpretation that informed the methodology the agency used to set

the Group 2 emission limits. In addition, even assuming the validity of that interpretation, Appalachian Power challenges the reasonableness of the methodology EPA employed. We reject both challenges.

1. *Statutory Interpretation of Section 407(b)(2)*

EPA believes that the statutory provision is ambiguous, both in its specific words and in their grammatical arrangement. Although ambiguous, EPA concludes that the best reading of the key statutory phrase, "comparable to the costs of," directs it to conduct a comparison of the cost-effectiveness of those control technologies available for Group 2 boilers with the cost-effectiveness of the NO_x controls required for Group 1 boilers (*i.e.*, low NO_x burner technology). And it reasons that the provision as a whole instructs it to base the Group 2 limits on the degree of emissions reduction achievable by those Group 2 technologies that compare favorably in cost-effectiveness with low NO_x burner technology. For these purposes, EPA measures cost-effectiveness in dollars per ton of NO_x removed (\$/ton-removed).³¹

Appalachian Power, by contrast, argues that the language of the statutory provision is unambiguous. It contends that the language requires a comparison of the costs of producing electrical output using control technologies that can be used

³¹ Appalachian Power charges that EPA's interpretation of "comparable cost" changed between April 1995 and its promulgation of the final rule at issue here. Appalachian Power notes that in April 1995, EPA said that in selecting Group 2 controls it would "consider only those systems ... that ... are comparable in cost to the average cost in constant dollars of low NO_x burner technology applied to Group 1 ... *as determined in section 3 below.*" 60 Fed. Reg. at 18,776 (emphasis added). The charge of change-of-position is unfair, however, because the first sentence of the "section 3" referred to in the quotation uses the same measurement of comparable cost EPA used in the final rule: "The Administrator will use the procedures ... specified in this section to estimate the average cost-effectiveness (in annualized \$/ton NO_x removed) of installed low NO_x burner technology applied to Group 1, Phase I boilers." *Id.*

in Group 2 boilers with the costs of producing electrical output using low NO_x burner technology in Group 1 boilers. Those costs, it argues, should be measured in dollars per kilowatt (\$/kw) and dollars per kilowatt hour (\$/kwh). In Appalachian Power's view, only those Group 2 technologies that compare favorably to low NO_x burner technology by this measure may be considered in setting the Group 2 limits.

Once again, *Chevron's* first step does not take us very far. The statute does not define the phrase "comparable to the costs of." As discussed below, we agree with EPA that the words in the phrase are ambiguous, *see* 61 Fed. Reg. at 67,138, and that the provision as a whole is grammatically awkward, *see id.* at 67,139. And although the legislative history does not definitively address the meaning of the phrase, we also agree with EPA that that history is supportive of the agency's interpretation.

To begin, both sides agree that the meaning of the word "cost" is the "price paid for a thing." App. Pwr. Br. at 33; EPA Br. at 34. Moreover, both agree that, depending upon the context, that "thing" could be either the amount of pollution removed (\$/ton-removed) or the amount of electricity produced (\$/kw or \$/kwh). Indeed, the word "costs" is used in two places in section 407(b)(2), and perhaps the best evidence of the essential ambiguity of the word is that each side adopts the other's definition for one of the two uses. Appalachian Power argues that \$/ton-removed is the appropriate way to define "costs" when they are "tak[en] into account" in determining "the best system of continuous emission reduction." App. Pwr. Br. at 32. It insists, however, that only \$/kw and \$/kwh will do for the key phrase, "comparable to the costs of nitrogen oxides controls." *Id.* at 33; App. Pwr. Reply Br. at 8. EPA would use the two definitions in precisely the opposite places. *See* EPA Br. at 35.

Turning to the grammatical structure of the statutory provision, Appalachian Power argues that its definition for the key phrase is "plainly" required because of the context in which the phrase is used. It contends that the antecedent of the word "which," in the phrase "which is comparable to the

costs of nitrogen oxides controls," is the phrase "the best system of continuous emission reduction." On this reading, it argues that EPA's job is to base emission limits on "the best system of continuous emission reduction ... which is comparable to the costs of nitrogen oxide controls." When comparing the costs of one system of controls to those of another, it argues, the appropriate comparison is the cost of producing electrical power.

Even if we were to adopt this view of the provision's grammar, it would be hard to conclude that Appalachian Power's definition is "plain." The syntax for which Appalachian Power argues simply does not resolve the question of "costs for what?" Although one certainly could compare the "costs" of two systems by comparing their costs for producing electrical output, one could also reasonably compare their costs for removing tons of pollution.

Moreover, we cannot agree that Appalachian Power's view of the provision's grammar is the only reasonable one. As EPA notes, to read the phrase "best system" as the antecedent of the word "which" would require deletion of both the semicolon and the word "and" that separate the two parts of the statutory provision. *See* 61 Fed. Reg. at 67,139. In EPA's view, the better reading is that the antecedent of "which" is the phrase "the degree of reduction achievable." On this reading, EPA urges, Congress contemplated that the agency would base Group 2 limits

on the degree of reduction (1) *which* can be reached through the best system of NO_x reduction, taking into account available technology, costs and energy and environmental impacts[;] and (2) *which* is "comparable to the costs" of [low NO_x burner] technology.

EPA Br. at 6 (emphases added). The only way to determine the degree of NO_x reduction that can be achieved in Group 2 boilers at costs comparable to the costs of low NO_x burner technology, EPA argues, is to consider the relative costs of controls per ton of NO_x removed. EPA contends that when one focuses on "degree of reduction" as the antecedent,

rather than on "best system," cost-effectiveness becomes the natural measurement to apply.

EPA's grammatical construction is plausible. But it is no more plausible than that of Appalachian Power because it, too, requires editing of the congressional text. This time, rather than make a deletion, we would need to make an addition. As noted in italics above, we would need to add the word "which," so that it appears twice rather than only once, in order to create a parallel construction that makes "the degree of reduction" the antecedent of both of the numbered phrases. The need to make that addition, however, only highlights its absence in the actual text and confirms the essential ambiguity of section 407(b)(2)'s key phrase.

Finding nothing dispositive in the statute's language or grammar, we look next to the legislative history for guidance. Appalachian Power argues that EPA's construction is inconsistent with the purpose of section 407(b)(2), which, Appalachian Power contends, was to ensure that the dollar "cost of controls" to owners of Group 2 boilers would not exceed the dollar "cost of controls" imposed on owners of Group 1 boilers—*i.e.*, not exceed the cost of low NO_x burners. We find little support in the legislative history, however, for Appalachian Power's view of the section's purpose. To the contrary, although we cannot say that the legislative history is dispositive, it does contain considerable support for EPA's view that cost-effectiveness is an appropriate measure of comparison, even if it is not the only appropriate measure.

Appalachian Power correctly notes that the language of section 407(b)(2) that directs EPA to set Group 2 emission limits, including the key phrase "comparable to the costs of," comes from the Senate bill. *Compare* 42 U.S.C. § 7651f(b)(2), *with* Clean Air Act Amendments of 1990, S. 1630, 101st Cong. § 407(b)(2) (1990) (Senate bill), *reprinted in* COMMITTEE ON ENV'T & PUB. WORKS, U.S. SENATE, A LEGISLATIVE HISTORY OF THE CLEAN AIR ACT AMENDMENTS OF 1990, at 4641 (1993) [hereinafter "LEGISLATIVE HISTORY"]. By contrast, the House version of the bill prevented EPA from regulating certain Group 2 boilers unless EPA, *inter alia*, found meth-

ods "available for reducing emissions from such boilers that are as *cost effective* as the application of low nitrogen oxides burner technology in the case of [Group 1] boilers." Clean Air Act Amendments of 1990, S. 1630, 101st Cong. § 506(a)-(c) (1990) (House bill) (emphasis added), *reprinted in* LEGISLATIVE HISTORY, at 2277. Appalachian Power contends that the conference committee's adoption of the Senate version—which did not use the phrase "cost effective" found in the House version—was tantamount to a rejection of the concept of cost-effectiveness. We disagree.

As a general matter, courts often have noted the difficulty of determining the significance of Congress's unexplained modification of language in earlier drafts of legislation, and have found that such modification does not necessarily indicate Congress's rejection of the substance of the earlier language. *See, e.g., Seatrain Shipbuilding Corp. v. Shell Oil Co.*, 444 U.S. 572, 594-95 (1980); *Edison Elec. Inst. v. EPA*, 2 F.3d 438, 451 (D.C. Cir. 1993). The two phrases at issue here—"comparable to the costs of" and "cost effective"—are not incompatible. It is possible that Congress regarded the two as synonymous, and that the conference committee simply adopted the Senate's formulation over that of the House.

Elements of the legislative history of the enacted version support this reading. Perhaps most persuasive is Congress's direction, in the conference report on the final bill, that EPA should base emission limits for Group 2 boilers on "methods that are available for reducing emissions from such boilers that are *as cost effective* as the application of low nitrogen oxide burner technology to [Group 1] boilers." H.R. CONF. REP. NO. 101-952, at 344 (emphasis added). Moreover, the conference report incorporates a section of the Senate report on an earlier Senate bill. That report equated the phrase "cost-effectiveness"—as measured by \$/ton-removed—with the phrase "comparable to the cost of":

Also favoring the *cost-effectiveness* of [section 407] is the development of new, lower-expense technologies.... [The] decreasing cost for selective catalytic reduction (SCR) may lower the expense of initial NO_x reductions even further. For example, SCR has long been viewed as prohibitively expensive, but recent dramatic declines

in cost have brought *the per-ton-removed price* of this technology down to as low as \$600.... This is *comparable to the cost of* conventional control methods like low NO_x burners....

S. REP. NO. 101-228, at 332-33 (1989) (emphases added). The Senate report also noted that with the NO_x emission limits, the Senate "intended to compel utilities to do no more than make the most *cost-effective* reductions." *Id.* at 332 (emphasis added).³²

Appalachian Power's general point, that Congress was concerned that the "costs" for Group 2 boilers be comparable to the "costs" for Group 1 boilers, is plainly correct. But there is no support for Appalachian Power's contention that Congress intended \$/kwh to define the word in the second part of section 407(b)(2), while expecting \$/ton-removed to define it in the first. Congress simply did not make the fine distinctions that the parties make here between different methods of measuring "costs." Indeed, when introducing the amendment that led directly to section 407(b)(2), various Senators referred interchangeably to the terms "cost-effectiveness," "low cost," and "not unreasonably expensive." *See, e.g.*, 136 CONG. REC. 5045 (1990) (statement of Sen. Chafee); 136 CONG. REC. 5045-46 (1990) (statement of Sen. Baucus); 136 CONG. REC. 5046 (1990) (statement of Sen. Lott). And during the floor debates on the conference report, Senator Burdick—conferee and Chair of the Senate Committee on Environment and Public Works—again equated "cost" and "cost-effective," stating that the Group 2 limits were to be set

only if the costs of such reductions are as cost effective as reductions from installation of low NO_x burners on

³² Although Senate Report No. 101-228 used the phrase "comparable to the cost of"—and used it synonymously with cost-effectiveness—the version of the Senate bill that was the subject of this report did not itself contain the phrase. However, the conference committee report on the final bill, which did contain the phrase, stated that: "Section 407(b)(2) is intended to incorporate a portion of ... S. Report 101-228, that the NO_x emission control technology requirements for [Group 2 boilers] are to reflect the relative difficulty of controlling NO_x emissions from these boilers." H.R. CONF. REP. NO. 101-952, at 344. While it is not entirely clear which portion of the Senate report the conference committee in-

other types of boilers.... This provision is carefully worded to make cost considerations the determinative factor in consideration of NO_x reductions from [Group 2] boilers.

136 CONG. REC. 36,029 (1990) (statement of Sen. Burdick).

In sum, we draw the same conclusion regarding the phrase "comparable to the costs of" in the 1990 amendments as the Supreme Court drew regarding the term "stationary source" in the 1977 amendments to the Act: neither the statutory language nor the legislative history is dispositive of the meaning of the term. *See Chevron*, 467 U.S. at 861-62.

Moving then to *Chevron's* second step, we must consider whether EPA's decision to interpret the statute as contemplating a comparison of cost-effectiveness is reasonable. In light of the above discussion, there is little left to say. Given the ambiguous syntax and the multiple meanings that both parties concede may be assigned to the word "costs," we cannot conclude that EPA's decision to use \$/ton-removed as the measurement of costs is unreasonable. Moreover, as our review of the legislative history suggests, although EPA's interpretation may not be required by that history, it surely is consistent with and supported by it. We thus conclude that EPA's construction of section 407(b)(2) is a permissible one.

*2. Challenges to EPA's Methodology for Determining Emission Limits*³³

Having concluded that it would base Group 2 emission limits on the capabilities of those Group 2 control technologies comparable in cost-effectiveness to low NO_x burner technology, EPA developed a test for making such comparisons. EPA found that it could not rely on a comparison of median or mean costs alone, because the \$/ton-removed cost for a given control technology, including low NO_x burners, varied widely from boiler to boiler even within the same category of boiler, and had different cost ranges for different categories

tended to incorporate, Senate Report 101-228's entire discussion of the "Nitrogen Oxides Emission Reduction Program" spans less than two pages and includes the quotations set forth in the text.

³³ We discuss here only those elements of EPA's methodology relevant to the challenges made by Appalachian Power and interve-

nor NMA.

of boilers. *See* 61 Fed. Reg. at 67,138, 67,143 (Table 12). For this reason, EPA determined that it needed a more comprehensive statistical approach. *See id.* at 67,138.

First, EPA excluded the cost-effectiveness figures for boilers in the top and bottom 10 percent of cost-effectiveness, so that neither the lowest nor the highest cost projects would skew the comparison. *See id.* at 67,143 (Table 13); *see also* EPA Response to Comments at 91-92 (Joint Appendix ("J.A.") 216-17).³⁴ Next, EPA determined that the cost-effectiveness of using a given type of Group 2 control technology for a specific category of Group 2 boiler (a technology/category combination) was comparable to the cost-effectiveness of using low NO_x burners in Group 1 boilers, if the median \$/ton-removed cost of that Group 2 technology/category combination: (1) did not exceed by more than one-third the overall median \$/ton-removed cost for low NO_x burners in Group 1 boilers, and (2) did not exceed the individual medians for both of the categories of Group 1 boilers.³⁵ *See id.* at 67,138, 67,143. Finally, EPA required

³⁴ Appalachian Power asserts that EPA excluded only the high cost projects. The indicated record citations make clear that this assertion is incorrect.

³⁵ The effect of this latter prong was to require that the median \$/ton-removed cost for any Group 2 technology/category combination not exceed the median \$/ton-removed cost of whichever of the two Group 1 boiler categories had the higher median cost. *See* 61 Fed. Reg. at 67,138; EPA Br. at 43 n.22. At various places, both EPA and Appalachian Power misstate this prong and its consequences, effectively reading it as requiring that the median \$/ton-removed cost for any Group 2 technology/category combination not exceed the median for either category of Group 1 boilers—hence that it be less than the lower of the two categories. *See* 61 Fed. Reg. at 67,138; App. Pwr. Br. at 36, 39. EPA acknowledges its misstatement, but notes that it was not used in the calculation of the actual Group 2 emission limits. *See* EPA Br. at 43 n.22; 61 Fed. Reg. at 67,143. Appalachian Power's misreading explains its incorrect contention that on the basis of EPA's own methodology the costs for two categories of Group 2 boilers (cyclones and wet bottom, wall-fired) are not comparable to the costs for Group 1.

that the 90th percentile of the \$/ton-removed cost range for Group 2 technology/category combinations not exceed the 90th percentile of the \$/ton-removed cost range for low NO_x burners in Group 1 boilers. *See id.* at 67,138.

Using this cost-comparison test and further calculations, EPA selected appropriate control technologies and an emission limit for each of the four statutory categories of Group 2 boilers, *see* 42 U.S.C. § 7651f(b)(2)(A)-(D) (wet bottom wall-fired boilers; cyclones; units applying cell burner technology; and "all other types of utility boilers"). It concluded that it could not set emission limits at all for two types of boilers in the catch-all fourth category because no control technology met the comparability test. *See id.* at 67,114. And it concluded that one kind of control technology was not cost-effective for two types of boilers, and so could not be used in setting emission limits for those boilers. *See id.* at 67,143.

Appalachian Power does not propose an alternative to the methodology EPA employed for setting the Group 2 emission limits. Instead, it and intervenor NMA charge that various elements of EPA's methodology are arbitrary and capricious, are unsupported by the record, or were used without following the Act's procedural requirements, and that we therefore must overturn the emission limits generated by EPA's methodology. Although we have considered and find all of petitioners' and intervenor's myriad arguments in this area lacking in merit, we discuss below only the more important of them.

a. *Significance of Cost as a Factor in Selection of Controls.* "Even assuming that Congress required EPA to compare the cost-of-tons reduced," Appalachian Power argues, EPA's comparison "is unlawful because it does not make cost a significant, much less a determinative factor." App. Pwr. Br. at 37. Appalachian Power contends that this is the result of EPA's choice of methodology, because when one uses a

fraction that divides costs by tons-removed, the fraction is "driven" by the denominator. *Id.* at 37-38. The proof that this is so assertedly is in the results that EPA's comparison test produces: the "costs" of the controls EPA has selected for Group 2, Appalachian Power claims, are "three to seven times higher than the costs of [low-NO_x] burners." *Id.* at 37-38 & n.119.

On its face, this is a difficult argument to understand. The key is to recognize that the argument actually mischaracterizes itself: it does not assume, as it claims, that the relevant "costs" are \$/ton-removed, but rather assumes they are \$/kwh. When Appalachian Power says the "costs" of the Group 2 controls are three to seven times the costs of Group 1 low NO_x burners, it can say so only by measuring those costs by \$/kwh—which is what it does. *See id.* at 38 n.119. Hence, in this argument Appalachian Power does not assume the validity of the measurement EPA has chosen, but simply relitigates, in different terms, the same argument we have rejected above.

b. *Weight Given to Smaller Boilers.* Appalachian Power contends that EPA manipulated its methodology to give unfair weight in Group 1 to smaller, underutilized boilers that are not cost-effective to retrofit with any controls, while giving more weight in Group 2 to larger, higher-utilized, and therefore more cost-effective boilers. This unfair comparison was made, Appalachian Power asserts, in order to ensure that high \$/ton-removed Group 2 technologies would still be comparable to Group 1 controls.

We see no evidence of this manipulation. Instead, as we have noted, EPA made a number of statistical adjustments, and in particular excluded figures for boilers in the top and bottom 10th percentiles, precisely to ensure that neither the lowest nor the highest cost projects skewed the comparison. *See EPA Response to Comments at 91-92 (J.A. 216-17).* The agency's decisions not to impose limits on two types of Group 2 boilers because those boilers did not pass its cost-

comparability test, and to exclude from consideration one kind of Group 2 control technology because it was too costly for two types of Group 2 boilers, are further evidence that EPA did not intentionally manipulate its methodology in order to ensure that expensive Group 2 controls would appear cost-effective.³⁶

c. Calculation of Cost-Effectiveness of Low-NO_x Burners.

Appalachian Power argues that EPA artificially inflated the costs of Group 1 controls, as compared to Group 2 controls, by not excluding from its database "a few extraordinarily high-cost" boilers in one of the two Group 1 categories (tangentially fired boilers). It contends that a total of ten specific Group 1 units (located at the Conemaugh, Shawville, and Joppa power plants) actually employ both low NO_x burners (the only required Group 1 technology) and technology "beyond low NO_x burners." It also contends that in calculating the costs of these units, EPA arbitrarily attributed most of the overall project costs to the low NO_x burners. Similarly, Appalachian Power argues that another two Group 1 units were "high-cost outliers" that should have been excluded from the database because they use a "novel burner" with extraordinarily high costs.

We have carefully considered the record with respect to these charges, but find little with which to work. Some of Appalachian Power's arguments appear to be incorrect factually. The allocation of costs between low NO_x burners and additional technology in some of the questioned units, for

³⁶ Appalachian Power also argues that for boilers of similar size and utilization, the \$/ton-removed costs for two kinds of Group 2 controls are higher than the \$/ton-removed costs for Group 1 controls. As EPA replies, however, the statute does not require that "comparability" be established on a size-of-boiler basis. The statistical parameters set by EPA and noted above reflect a reasonable attempt by the agency to account for the range of costs of different control technologies operating in different sizes and categories of boilers.

example, was based on estimates provided by the utilities themselves. *See* J.A. 1828-68; EPA Response to Comments at 91 (J.A. 216). Although the allocation in the other units was based on EPA's own estimates, *see* EPA Response to Comments at 90-91 (J.A. 215-16), Appalachian Power does not explain the manner in which it was "arbitrary." And there is simply a factual dispute between Appalachian Power and EPA as to whether the burners in the remaining two units are "novel" or not. *Compare* App. Pwr. Br. at 41, with EPA Response to Comments at 352-53, 358-59 (J.A. 475-76, 481-82). We will not substitute our judgment for EPA's in this highly technical area. *See Troy Corp. v. Browner*, 120 F.3d 277, 283 (D.C. Cir. 1997).

d. Calculation of the Cost-Effectiveness of Gas Reburn.

On the other side of the equation, Appalachian Power argues that EPA artificially depressed the cost of one particular Group 2 control technology—gas reburn—by using national rather than regional projections of an important element of its cost, namely the price of natural gas. It also contends that gas reburn is not truly an "available" technology, because it has been used only in two small boilers in the United States. Hence, Appalachian Power contends, EPA's predictions of the cost of this Group 2 technology are arbitrary. The statute bars us from considering the first argument because it was not raised with the agency during the rule-making. *See* 42 U.S.C. § 7607(d)(7)(B); EPA Br. at 50-51. The second argument is answered adequately by EPA's reliance on experience with gas reburn in boilers outside the United States, *see* EPA Response to Comments at 206-07 (J.A. 330-31); J.A. 1904-06. Nothing in the statute bars EPA from considering such data.

e. Calculation of Cost-Effectiveness of Selective Catalytic Reduction. Appalachian Power also launches an attack on the methodology used to determine the cost-effectiveness of another Group 2 technology, selective catalytic reduction ("SCR"). In order to assess the cost-effectiveness of SCR, EPA had to determine the predicted use of boilers in the year

2000. To do this, it employed a statistical model known as the Integrated Planning Model ("IPM") and conducted a number of runs of the model using varying assumptions. As we have noted in Part II.A above, our consideration of EPA's use of computer models proceeds with considerable deference to the agency's expertise. *See American Iron & Steel Inst.*, 115 F.3d at 1005; *Chemical Mfrs. Ass'n*, 28 F.3d at 1264-65.

Appalachian Power contends that EPA did not give sufficiently early notice of the assumptions it would use in the IPM, nor of the results of a June 1996 run of the model in which SCR proved less cost-effective than in the April run that was used in developing the final rule. The IPM's predictions for boiler utilization in the year 2000, as well as the final assumptions of the model and the results of the contested June 1996 modeling run, were not placed in the rulemaking docket until November 22, 1996—two and a half weeks before EPA signed the final rule on December 10, 1996.³⁷ Although the two-and-a-half week notice period is certainly short, under the circumstances of this rulemaking discussed below, we find it adequate. *Cf. Natural Resources Defense Council v. Thomas, Inc.*, 838 F.2d 1224, 1242-43 (D.C. Cir. 1988) (finding two-week comment period adequate).

In its January 1996 proposed rule, EPA initially announced that it would use a model called the Coal and Electric Utilities Model ("CEUM") to predict boiler utilization in the year 2000. However, commenters, including some of the utilities petitioning here, submitted criticisms of the CEUM while noting advantages of the IPM. *See* J.A. 1409, 1416-17; 61 Fed. Reg. at 67,143; EPA Response to Comments at 94-100, 354-58 (J.A. 219-25, 477-81). EPA concluded that it should use the IPM instead because it had been used by

³⁷ Although Appalachian Power initially contended that it did not learn this information until December 1996, at oral argument its counsel did not contest that it had the information as of November 22, 1996.

numerous major utilities, again including some petitioning here, for their own planning purposes, *see* EPA Response to Comments at 95 (J.A. 220). In April 1996, at a public forum on a related regulatory initiative, EPA provided documentation of how the model was used and of actual model runs, and requested comments. Again, commenters, including some petitioning here, made submissions and the agency made further adjustments to the model's assumptions. In April, the agency conducted a run of the model incorporating these changes and then used it to formulate the final rule at issue here. Subsequently, EPA made additional changes in the model's assumptions, and then reran the model in June. *See id.* at 95-96, 354 (J.A. 220-21, 477). In September, EPA met again on the related initiative with some of the petitioners here, and further explained the IPM. *See id.* at 354 (J.A. 477). And on November 22, the IPM's final assumptions and predictions, as well as the results of the contested June 1996 modeling run, were placed in the rulemaking docket.

Viewed in this context, as part of a series of refinements in the agency's model in response to the suggestions of commenters, we conclude that the relatively short period available for further submissions at the end of the rulemaking was reasonable. The agency's use of the IPM in these circumstances constituted a "logical outgrowth" of its original proposal. *See Fertilizer Inst.*, 935 F.2d at 1311. Hence, we find no procedural violation.

Moreover, as we have previously noted, even if the late filing of the final IPM materials had constituted procedural error, we may invalidate a Clean Air Act rule for procedural errors "only if the errors were so serious and related to matters of such central relevance to the rule that there is a substantial likelihood that the rule would have been significantly changed if such errors had not been made." 42 U.S.C. § 7607(d)(8). Yet, Appalachian Power does not even expressly make this assertion. We interpret its point about the June 1996 run as implying that if Appalachian Power had known about it earlier, it would have called it to EPA's attention, and that as a consequence EPA would not have used SCR in determining the Group 2 rates. The flaw in this argument is

that EPA did not need Appalachian Power's help to learn of the results of its own modeling run. Nor did EPA ignore those results. EPA conducted a sensitivity analysis of the differences between the April and June runs, in order to determine whether the differences were sufficiently significant to affect the final rule. *See* EPA Response to Comments 354-55 (J.A. 477-78). Based on that analysis, EPA concluded that the April run provided a reasonable basis for establishing the limits in the final rule, and that using the June run would not significantly change those limits. *See id.* at 357 (J.A. 480). Although EPA set out its sensitivity analysis in detail in its final Response to Comments, *see id.* at 355-360 (J.A. 478-83), Appalachian Power has not attempted to identify any defect in that analysis, and hence cannot establish that earlier docketing of the June run would have led to a significant change in the final rule.

In addition to attacking the IPM, Appalachian Power also challenges what it characterizes as "other assumptions" relating to SCR. Again, Appalachian Power gives us little with which to work. It lists a number of asserted flaws in EPA's methodology which, it says, are merely "examples" of the agency's bias in favor of this technology. But EPA adequately responded to each of these challenges during the rulemaking,³⁸ and Appalachian Power provides no basis for question-

³⁸ Appalachian Power argues, "for example," that EPA's model excluded from the calculation of Group 2 costs the cost of so-called "scope adders"—other work completed at the same time as the installation of NO_x control equipment. The exclusion was appropriate, however, because scope adders are usually not part of the NO_x reduction effort, and, in any event, these costs were excluded from the calculation of both Group 2 and Group 1 costs. *See* 61 Fed. Reg. at 67,144-45, 67,147; EPA Response to Comments at 172-74 (J.A. 296-98). Appalachian Power also contends that rather than obtain site-specific cost information from the electrical utilities, EPA's model used a statistical technique known as "power law scaling" to estimate the capital costs for larger boilers based on actual data from smaller boilers in the same category. But the technique, which also is employed by electric utilities, *see* EPA Response to Comments at 135-37, 351-52 (J.A. 259-261, 474-75); J.A. 680-84, is reasonable because EPA used it where the data offered by the utilities consisted of estimates that were insufficiently supported, *see* 61 Fed. Reg. at 67,148-49; EPA Response to

ing the agency's assumptions regarding SCR in any larger sense.

Finally, Appalachian Power contends that EPA did not select SCR or gas reburn as a basis for the emission limit for wet bottom boilers until the announcement of the final rule. Although Appalachian Power is correct that SCR and gas reburn were not specifically proposed for wet bottom boilers, the agency's proposed rule did solicit comments regarding the use of both technologies in such boilers. *See* 61 Fed. Reg. at 1464, 1474 (gas reburn); *id.* at 1457 (SCR). Commenters clearly understood that these technologies were under consideration, as the agency received comments on them from several sources, *see* J.A. 905-09, 1063-81; 61 Fed. Reg. at 67,150-51; EPA Response to Comments at 232-36, 360 (J.A. 356-60, 483), including some of the utilities petitioning here, *see* J.A. 989-91, 1004-116, 1169-72. As we have noted, this kind of agency modification of a proposed rule, in response to the comments it solicited and received on alternative possibilities, complies with the requirements of administrative law. *See Natural Resources Defense Council*, 838 F.2d at 1242; *Small Refiner Lead Phase-Down Task Force v. EPA*, 705 F.2d 506, 547 (D.C. Cir. 1983).

f. *Subcategorization of Boiler Types.* Appalachian Power challenges EPA's failure to adopt a proposal to regulate as separate subcategories, or to exclude from regulation altogether, those Group 1 and 2 boilers where retrofitting allegedly could damage the units or only be accomplished at high cost. As EPA notes, however, the statute establishes specific categories of boilers (two Group 1 categories and four Group 2 categories, *see supra* notes 4-5), and does not contemplate further subcategorization or boiler-by-boiler treatment. EPA states that it has no evidence to support the claim that boilers

Comments at 174-87 (J.A. 298-311). As yet another "example," Appalachian Power contends that EPA assumed a price for ammonia, consumed in large quantities during the SCR process, that appears lower than the price reported by the utilities. EPA correctly points out that the disparity is due to the fact that EPA's price was expressed in 1990 dollars. *See* EPA Response to Comments at 176-77, 185 (J.A. 300-01, 309).

in Appalachian Power's proposed subcategories cannot in general achieve the same emission rates as other boilers in the statutory categories, *see* EPA Response to Comments at 67 (J.A. 192), and Appalachian Power has offered nothing to justify disturbing this agency conclusion. EPA further notes that its statistical methodology took account of the range of cost-effectiveness of boilers within categories, and that the remedy for the owner of an individual unit that cannot achieve category limits is to request an alternative emission limit under 42 U.S.C. § 7651f(d), or to seek permission to average emissions from several units under 42 U.S.C. § 7651f(e). *See* EPA Response to Comments 67, 254 (J.A. 192, 378). EPA's response to this proposal is reasonable, and its rejection of the proposal is neither arbitrary nor capricious.

g. Consideration of Environmental Impacts in Setting Limits. Finally, intervenor NMA argues that EPA improperly relied on an irrelevant factor—the environmental impacts of the rule—when setting the NO_x emission limits for Group 2 boilers. This argument is answered, however, by the plain language of section 407(b)(2), which requires EPA to consider environmental impacts. *See* 42 U.S.C. § 7651f(b)(2) (directing EPA to set emission limits and "base such rates on the degree of reduction achievable through the retrofit application of the best system of continuous emission reduction, taking into account available technology, costs and energy and *environmental impacts*") (emphasis added).³⁹

³⁹ NMA also argued that "the Coal Industry did not know until the final rule" that EPA intended to consider the adverse environmental effects of NO_x in setting emission rates. NMA Br. at 13. In fact, EPA gave notice in its initial proposal that it intended to do so. *See* 61 Fed. Reg. at 1442, 1453-55. Nor do we find support for NMA's brief, unfleshed-out allegation that even if EPA were entitled to consider environmental impacts, it did so unreasonably. *See* NMA Br. at 9-10. EPA moved to strike NMA's entire argument regarding the consideration of environmental factors in setting Group 2 limits, on the ground that no petitioner had raised it. Although the question is close, there is much to be said for EPA's contention that intervenor NMA impermissibly has enlarged the issues before this court. *See, e.g., Public Serv. Co. of Colo. v.*

In sum, finding none of petitioners' challenges to the Group 2 emission limits persuasive, we uphold the limits EPA established for boilers in that Group.

C. *The Compliance Deadline*

Appalachian Power also challenges EPA's assertion that, pursuant to section 407(a), the new emission limits must be met by January 1, 2000. Section 407(a) provides:

On the date that a coal-fired utility unit becomes an affected unit pursuant to sections 7651c [Phase I sulfur dioxide requirements], 7651d [Phase II sulfur dioxide requirements], [or] 7651h [repowered sources] of this title, or on the date a unit subject to the provisions of section 7651c(d) or 7651h(b) of this title, must meet the SO₂ reduction requirements, each such unit shall become an affected unit for purposes of this section and shall be subject to the emission limitations for nitrogen oxides set forth herein.

42 U.S.C. § 7651f(a). Because a Phase I "affected unit" (defined as "a unit that is subject to emission reduction requirements or limitations under this subchapter," 42 U.S.C. § 7651a(2) (1994)) must come into compliance with sulfur dioxide emissions limits by January 1, 1995, and because a Phase II affected unit must comply by January 1, 2000, EPA stated in the final rule that the deadline for compliance with the new NO_x emission limits for Group 1, Phase II boilers and for Group 2 boilers would be January 1, 2000. *See* 61 Fed. Reg. at 67,154. Appalachian Power argues, however, that section 407(a) does not require such a deadline—that, in fact, the only statutory deadline is that included in the last sentence of section 407(b)(1), which states that "[a]fter January 1, 1995, it shall be unlawful" for Group 1, Phase I boilers to emit NO_x in excess of the established emission rates. *See* 42 U.S.C. § 7651f(b)(1). As a result, Appalachian Power argues,

FERC, 91 F.3d 1478, 1488 n.3 (D.C. Cir. 1996), *cert. denied sub nom. Amoco Prod. Co. v. Public Serv. Co. of Colo.*, 117 S. Ct. 1723 (1997); *Time Warner Entertainment Co. v. FCC*, 56 F.3d 151, 202 (D.C. Cir. 1995), *cert. denied*, 116 S. Ct. 911 (1996). However, since EPA easily prevails on the merits of NMA's argument, we see no harm to EPA in denying its motion.

EPA must otherwise justify its decision to establish a compliance deadline of January 1, 2000.

Before reaching the merits of this argument, we must first dispose of a procedural issue. Appalachian Power's comment on the compliance deadline during the notice-and-comment period argued that, unlike other statutory sections, section 407(b)(2) contains no date after which "it shall be unlawful" to exceed the emission limitations set under the section. Appalachian Power's current argument points out the anomaly of construing the "plain language" of the statute as establishing a compliance date for Group 2, Phase I boilers given that these boilers become "affected units" in 1995, while the Group 2 limits are not required to be promulgated until 1997. EPA seizes on the difference between these two challenges to argue that because Appalachian Power failed to raise its current argument before EPA during the notice-and-comment period, its challenge should be considered waived. We disagree. It is true that under the Act, only an objection to a rule or procedure that was raised with "reasonable specificity" during the comment period may be raised during judicial review. 42 U.S.C. § 7607(d)(7)(B). But the word "reasonable" cannot be read out of the statute in favor of a hair-splitting approach. In other words, the Act does not require that precisely the same argument that was made before the agency be rehearsed again, word for word, on judicial review. The purpose of the exhaustion requirement is to ensure that the agency is given the first opportunity to bring its expertise to bear on the resolution of a challenge to a rule. *See, e.g., Fertilizer Inst.*, 935 F.2d at 1312-13 (citing *Cutler v. Hayes*, 818 F.2d 879, 890-91 (D.C. Cir. 1987)) (discussing general exhaustion requirement). So long as EPA has considered the particular challenge raised on judicial review, it is of no import whether that challenge is phrased in exactly the same way in each forum. Appalachian Power's argument regarding the compliance deadline during the comment period—in substance, if not in form, the same objection now raised—was sufficient to put EPA on notice of a challenge to its claim that it was bound by the statute in

setting the compliance date for the Group 1, Phase II boilers and the Group 2 boilers at January 1, 2000.

EPA's reliance on *Ohio v. EPA*, 997 F.2d 1520 (D.C. Cir. 1993), is therefore unavailing. In that case, we rejected the petitioners' contention that a comment challenging EPA's definition of "onsite" as limited to contiguous areas was sufficient to raise a challenge to EPA's proposed treatment of noncontiguous but reasonably related facilities as a single site, noting that "this minimal reference to the contiguity issue is so tangential to the principal thrust of the comment that it cannot fairly be said to have been presented to EPA for resolution." *Id.* at 1550. This case is distinguishable from *Ohio*, in which two distinct actions were challenged: EPA's treatment of contiguous areas as "onsite" and EPA's treatment of reasonably related noncontiguous areas as a single site. Here, both challenges were directed at a single claim: that EPA had no discretion in setting the compliance date.

Even if Appalachian Power could be deemed not to have raised this argument before the agency, we have noted that EPA "retains a duty to examine key assumptions as part of its affirmative 'burden of promulgating and explaining a non-arbitrary, non-capricious rule'" and therefore that "EPA must justify that assumption even if no one objects to it during the comment period." *Small Ref. Lead Phase-Down Task Force*, 705 F.2d at 534-35 (quoting *National Lime*, 627 F.2d at 433). Because the compliance date for a particular rule would almost certainly be included with these "key assumptions," we are not prohibited from considering Appalachian Power's argument.

Given that the issue is properly before us, we go on to decide whether EPA's conclusion that the statute requires a January 1, 2000, compliance date is valid. EPA argues that because Phase II units must meet the SO₂ requirements by January 1, 2000 (*see* 42 U.S.C. § 7651d(a)), section 407(a), by using the SO₂ deadline as the deadline for NO_x compliance, also requires a deadline of January 1, 2000. Appalachian Power challenges this conclusion, arguing that pursuant to

this logic, the compliance date for Group 2, Phase I boilers would be January 1, 1995 (the date on which they became "affected units" for SO₂), a date prior to the promulgation of the emission limits at issue. Rather, Appalachian Power argues, section 407(a) identifies which units are subject to the NO_x program, not when they must comply with regulations issued under the section. Because Congress set a compliance date of January 1, 1995, for Group 1, Phase I boilers and did not set any other deadlines in the section, Appalachian Power argues that Congress left it to EPA's discretion to set a compliance date for the remaining boilers.

We are presented with a question of statutory interpretation, so once again we conduct a *Chevron* analysis to determine, first, whether Congress has spoken on the issue of the compliance deadline for Group 1, Phase II units and Group 2 units, and, second, if Congress has not so spoken, whether EPA's selection of a January 1, 2000, deadline was a reasonable interpretation of the statutory scheme.

A careful reading of section 407 leads us to the conclusion that Congress did not include a specific compliance date for NO_x emission limits promulgated under section 407(b)(2). While section 407(a) does state that the date that a boiler becomes "subject to" any NO_x limitations is the same date that it becomes an affected unit for purposes of SO₂ emission limitations—January 1, 1995, for Phase I units and January 1, 2000, for Phase II units—we do not interpret the phrase "subject to" to mean "must be in compliance with." To do so would render the last sentence of section 407(b)(1), which establishes a compliance date of January 1, 1995, for Group 1, Phase I boilers, superfluous. Because we should refrain from interpreting a statutory provision in a way that creates surplusage, *see, e.g., Motor and Equipment Mfrs. Ass'n, Inc. v. EPA*, 627 F.2d 1095, 1108 (D.C. Cir. 1979), we conclude that the inclusion of a specific compliance date in section 407(b)(1) means that the phrase "subject to" in section 407(a) cannot refer to compliance. (This conclusion does not, however, render the phrase meaningless; rather, it may mean simply that each boiler becomes subject to regulation under the NO_x program at the same time it becomes subject to the

SO₂ program; once subject to regulation, a boiler is required to meet the compliance date of any NO_x emission limits promulgated.) As a result, because section 407(b)(2) does not specify a compliance date, it would appear that Congress did not intend to set a compliance date for these boilers. This conclusion is bolstered by the fact that reading a compliance date into section 407(a) would, as Appalachian Power points out, result in the requirement that Group 2, Phase I boilers comply in 1995 with a regulation not promulgated until 1997. We cannot conclude that Congress desired such an absurd result.

Because our reading of the statute reveals a gap to be filled by EPA, we next determine, under the second step of the *Chevron* analysis, whether EPA's resolution—designating January 1, 2000, as the compliance date for both Group 1, Phase II boilers and all Group 2 boilers—is reasonable.⁴⁰ We believe that it is. A compliance date of January 1, 2000, provides utilities with at least two years of lead time to prepare for compliance, a period at least twice as long as the preparation time for the 1995 emission limits and one that "reflects the relative difficulty of controlling NO_x for [Group

⁴⁰ As Appalachian Power notes, we have previously held that "when an agency's decision rests on a supposed mandate by Congress and the agency is later determined to be wrong as to the mandate, a remand may be required for it to exercise its discretion on the issue." *General Motors Corp. v. National Highway Traffic Safety Admin.*, 898 F.2d 165, 171 (D.C. Cir. 1990). In this case, however, remand would be an exercise in futility because EPA has already stated in the preamble to the final rule that even if the compliance-date provisions are considered to be ambiguous, "the Agency maintains that its interpretation is reasonable." 61 Fed. Reg. at 67,155 n.24. It is evident that EPA considered environmental concerns as an alternative reason for setting the compliance deadline at January 1, 2000. *See, e.g.*, EPA Response to Comments at 270 (delaying compliance beyond January 1, 2000, would cause "unnecessary environmental harm"). Thus, this is not a case in which EPA has "stopped at text and history without weaving into the calculus policy and administrative concerns," *General Motors*, 898 F.2d at 172, which might compel us to remand.

2] technologies," S. REP. NO. 101-228, at 332. In addition, January 1, 2000, is the date by which the Phase II boilers must comply with the SO₂ limits and is the last such compliance date explicitly mentioned in Title IV (save for section 409(b)(1), which permits an extension of the compliance date for repowered sources from January 1, 2000, to December 31, 2003, *see* 42 U.S.C. § 7651h(b)(1) (1994)). Given these considerations, we can find no reason to conclude that a January 1, 2000, compliance date is unreasonable, and thus we decline to vacate this portion of the rule.

D. *The Classification of Retrofitted Cell Burner Boilers*

In this part we consider the proper classification of one kind of dry bottom wall-fired boiler (hereinafter, "wall-fired boiler"), known as a "cell burner." In such a boiler, two or three closely-spaced burners are clustered in "cells," which are placed on opposing walls. Under section 407(b), a wall-fired boiler is classified as Group 1, unless it is a unit "applying cell burner technology," in which case it is classified as Group 2. *Compare* 42 U.S.C. § 7651f(b)(1)(B), *with* 42 U.S.C. § 7651f(b)(2)(C). The classification is important to the boiler's owner, because the Group 1 emission limit for wall-fired boilers is stricter than the Group 2 limit for cell burners.

In issuing its final rule, EPA concluded that retrofitting a cell burner with "non-plug-in" NO_x controls "convert[s]" the cell burner to a wall-fired boiler. *See* EPA Response to Comments at 129 (J.A. 253). The agency determined that cell burners that were retrofitted prior to the date of enactment of the 1990 amendments (November 15, 1990) should therefore be classified as Group 1, wall-fired boilers and subject to the more stringent limit. However, EPA permitted those cell burners retrofitted after the date of enactment to remain subject to the more lenient limit applicable to Group 2.

As a consequence of EPA's classification decision, petitioner Arizona Public Service Company ("APS") has two identical boilers, one retrofitted in 1989 (Unit 4) and one retrofitted in 1991 (Unit 5), that are subject to very different emission limits. APS charges that the classification of a retrofitted

cell burner—and particularly its Unit 4—as a wall-fired boiler is arbitrary and capricious. It also contends that the distinction EPA made between retrofitted cell burners, based on the date of their retrofitting, is arbitrary and capricious.

We agree that on the present record EPA has not justified its classification of retrofitted cell burners as wall-fired boilers, and hence vacate and remand the issue to the agency for further consideration. Because we conclude that EPA has not justified the classification of any retrofitted cell burner as a wall-fired boiler, we do not consider whether EPA's effort to distinguish between retrofits based on the date of retrofitting was also arbitrary.⁴¹

The question whether a retrofitted cell burner can properly be classified as a wall-fired boiler turns upon whether a retrofitted unit is still a unit "applying cell burner technology." 42 U.S.C. § 7651f(b)(1)(B). Neither party contends that this question can be resolved under *Chevron's* step one. We agree that neither the statutory language nor the statute's structure unambiguously decides the issue. There also is no indication in the legislative history that Congress considered the question of the effect of a retrofit on the appropriate classification of a cell burner. This is a case in which Congress "has not directly addressed the precise question at issue," *Chevron*, 467 U.S. at 843, and we therefore proceed to *Chevron's* step two.

Under step two, the question is whether the agency's interpretation of the statute is reasonable when measured against the statute's language, legislative history and purpose. EPA argues that its classification of a retrofitted cell burner as no longer "applying cell burner technology" is reasonable. In a "non-plug-in" retrofit, portions of the wall that held the clustered burners are removed, and more widely

⁴¹ We do note, however, that EPA made the distinction at least in part to benefit utilities like APS, so that some of their units would continue within Group 2. Having concluded that all cell burners retrofitted with non-plug-in controls are essentially wall-fired boilers, the agency nonetheless agreed to keep those retrofitted after

spaced burners are installed. EPA argues that once this is accomplished, the salient feature of a cell burner—the clustering of burners in cells—has disappeared, and that thereafter the boiler is wall-fired for all intents and purposes.⁴²

APS contends, and we agree, that the interpretive question is not simply what the retrofitted boiler looks like ("cellular" or not), but whether it retains the attributes that Congress relied upon in placing cell burners in Group 2. APS argues that Congress placed in Group 2 those boilers whose NO_x emissions were more difficult to control. The conference report on the Act's amendments supports this view, *see* H.R. CONF. REP. NO. 101-952, at 344, and the remaining legislative history contains no indication of any other rationale Congress may have had.

Using this indication of congressional intent, APS argued in the rulemaking that cell burners have a number of relevant characteristics, besides the clustering of the burners. Such boilers were designed in the 1960s with the purpose of concentrating heat in a smaller space. As a consequence, the salient physical features are small boiler size as well as the location of the burners. The small size, APS argued, leads to a higher burner zone release rate ("BZRR") in such a boiler, even when the burners are unclustered via retrofitting. *See* APS Comments at 15-16 (J.A. 1038-39). And BZRR, APS

1990 within Group 2, contending, in part, that this would provide utilities with an incentive to retrofit as a way to reduce NO_x emissions. *See* EPA Response to Comments at 129 (J.A. 253).

⁴² This issue may be one of dwindling significance. Although APS retrofitted its units with "non-plug-ins," the only technology then available, in the future utilities likely will be able to retrofit cell burners with "plug-ins," which replace the existing burners with low NO_x burners while maintaining the original cell configuration. *See* 61 Fed. Reg. at 1457-58. EPA has not contended that a plug-in retrofit converts a cell burner into a wall-fired boiler. *Id.*

contended, is the driving force behind the high NO_x emission levels of cell burners. *See id.* at 15-17 (J.A. 1038-40).⁴³

Moreover, APS argued, the proof that retrofitted cell burners are not the functional equivalent of wall-fired boilers is in their performance. Retrofitted cell burners have much higher emission rates than wall-fired boilers. In fact, APS contended, of the four retrofitted cell burners in the country, only two can achieve the Group 1 emission limit for wall-fired burners. And those two should not be considered, APS further argued, because they achieve the Group 1 limit only by using overfire air as well as low NO_x burners. *See id.* at 15 (J.A. 1038). We agree that the fact that no retrofitted cell burner can achieve the Group 1 emission limit using the only technology Congress authorized for setting that limit (low NO_x burner technology) is evidence that retrofitted cell burners are not the functional equivalent of wall-fired boilers, as measured by congressional concerns.

In the rulemaking, EPA's only response to APS's contention about the salience of small boiler size and its relationship to BZRRs was to say that APS did "not provide[] any

⁴³ EPA's appellate counsel argues that although the agency agrees with APS that Congress placed cell burners within Group 2 because of the greater difficulty of controlling their NO_x emissions, Congress attributed this difficulty to the cellular configuration and not to the high BZRR. As support, EPA cites a report the Department of Energy presented to Congress prior to the passage of the 1990 amendments. That report stated that the configuration of the burners in cells "results in combustion conditions that produce high NO_x emissions." OFFICE OF CLEAN COAL TECH., DEP'T OF ENERGY, COMPREHENSIVE REPORT TO CONGRESS CLEAN COAL TECHNOLOGY PROGRAM: FULL-SCALE DEMONSTRATION OF LOW-NO_x CELL BURNER RETROFIT, at 1 (1990) (J.A. 493). APS notes, however, that the same report also refers to the relationship between small boiler size, and correlative high BZRR and increased NO_x formation. *See id.* at 10 (J.A. 502). Moreover, EPA offers no evidence that

information supporting [this] claim." EPA Response to Comments at 129 (J.A. 253). This assertion is contradicted by the rulemaking record. *See* APS Comments at 15-17 (J.A. 1038-40).⁴⁴ Nor can we find any evidence that EPA responded at all to APS's comment that the only retrofitted cell burners capable of meeting the more stringent emission limit are those boilers that also use overfire air technology. This failure to respond adequately to key questions about the reasonableness of the agency's position requires a remand. *See Motor Vehicles Mfrs. Ass'n v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 43 (1983).

On appeal, EPA counsel contends that the fact that few if any retrofitted cell burners can meet the wall-fired limit does not mean the limit is invalid. That, EPA argues, simply puts them in the same category as the 12 percent of all wall-fired boilers that cannot achieve the standard. As we have agreed above, the statute does not require that EPA set limits so that all boilers in a category can achieve them. One problem with EPA's argument here, however, is that it is an impermissible post hoc rationalization of appellate counsel. *See, e.g., Unbelievable, Inc. v. NLRB*, 118 F.3d 795, 809 n.3 (D.C. Cir. 1997). The larger problem is that it assumes the point that is at issue, *i.e.*, that the retrofitted cell burners *are* wall-fired boilers. If they are, then EPA is correct that any individual unit's inability to meet the Group 1 limit does not invalidate the standard as a whole. But APS points to these units' inability to achieve the Group 1 limit not as part of an attack on the overall standard, but rather as evidence that EPA's effort to equate retrofitted cell burners and wall-fired boilers is invalid. EPA, even through its counsel, does not answer this argument.

Congress relied on or was aware of this report when enacting the 1990 amendments.

⁴⁴ On appeal, EPA also takes issue with APS's data on BZRRs. As EPA did not raise this objection during the rulemaking, we reject it now as an impermissible post hoc rationalization, *see Unbelievable, Inc. v. NLRB*, 118 F.3d 795, 809 n.3 (D.C. Cir. 1997), but pass no judgment on its merit upon remand.

Because EPA has not adequately justified its treatment of retrofitted cell burners as wall-fired boilers, we vacate and remand the issue to the agency for reconsideration or a more adequate justification.

III. CONCLUSION

For the foregoing reasons, we uphold EPA's NO_x emission limits for the Group 1, Phase II boilers, the emission limits for the Group 2 boilers, and the compliance date of January 1, 2000, as neither exceeding EPA's statutory authority under Title IV of the Clean Air Act nor arbitrary and capricious. We thus deny Appalachian Power's petition for review in its entirety. However, we grant APS's petition for review, vacate EPA's classification of certain retrofitted cell burners as wall-fired boilers as arbitrary and capricious, and remand to the agency for reconsideration or a more adequate explanation.

It is so ordered.