# Comment

## Comment on *Beyond the New Deal**

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The *Journal* recently printed a lengthy article entitled *Beyond the New Deal: Coal and the Clean Air Act*,[1] which attacks the Environmental Protection Agency's 1979 air pollution standard for new coal-fired power plants.[2] The authors state that "the agency action is so inept that some of the nation's most populous areas will enjoy a *worse* environment than would have resulted if the new policy had never been put into effect."[3] The authors also charge that this "extraordinary agency decision . . . will cost the public tens of billions of dollars to achieve environmental goals that could be reached more cheaply, more quickly, and more surely by other means."[4] The article confidently advised the United States Court of Appeals for the District of Columbia Circuit, then considering challenges to the EPA's standard,[5] that the agency's decision to promulgate the standard suggests "a strong remand" to the EPA.[6] The court of appeals has now upheld the agency's new power plant standard in all respects,[7] but

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1. Ackerman & Hassler, *Beyond the New Deal: Coal and the Clean Air Act*, 89 YALE L.J. 1466 (1980) [hereinafter cited by page number only].

2. 44 Fed. Reg. 33,580-624 (1979) (codified in 40 C.F.R. § 60.43a (1980)).

3. P. 1469.

4. *Id.*

5. Sierra Club v. Costle, No. 79-1565 (D.C. Cir. Apr. 29, 1981). Environmentalists challenged the standard as too lax and utilities contended, like Ackerman and Hassler, that the standard was too strict. *See id.*, slip op. at 7. Unlike Ackerman and Hassler, however, the utilities did not argue that the statutory requirements "could be satisfied by burning untreated low sulfur coal alone, without utilizing scrubbers or other 'add-on' control technology." *See id.* at 19-20 n.38 (comparing contentions of parties to those of Ackerman and Hassler).

The case was argued on September 22, 1980. Ackerman and Hassler's article appeared in early September. This comment was submitted to the *Journal* in late March 1981.

6. P. 1566.

7. The three-judge panel affirmed the standard as reasonable in all respects. Judge Wald reviewed and rejected the challenges to the standard in a thorough 253-page opinion, in which Judge Ginsburg concurred; Judge Robb concurred in the result. No party sought rehearing by the panel, rehearing *en banc*, or certiorari review by the Supreme Court. *See* Docket Sheet, Sierra Club v.

the issue remains timely because Congress and the Executive are considering amendments to the Clean Air Act.[8]

The standard is controversial and, as another recent study observes, it "has been criticized by environmental organizations that believe that it is not sufficiently strict, and by the utility industry and some academic commentators because it discriminates against the use of low-sulfur coal and less costly (although less effective) control techniques."[9] The Ackerman and Hassler article is one of the more provocative and original in the debate over the standard. It makes important points about the way the EPA and Congress reach environmental decisions, a process that could be significantly improved. As a process critique, the article makes a contribution.

The authors' substantive argument for reversal of the 1979 standard is seriously flawed, however, both by methodological problems and by questionable factual assertions. The article offers a detailed technocratic analysis of the disadvantages of "forced scrubbing."[10] Yet the 1979 standard adopted by the EPA, to which the authors devote almost no attention, achieves substantially greater environmental gains at lower cost than "forced scrubbing." The authors also ignore important related environmental standards and fail to discuss leading judicial decisions that bear on the 1979 standard. In addition, the authors contend that coal cleaning at all old plants and the use of other control options would achieve "bigger gains sooner and more cheaply"[11] than would forced scrubbing at new ones. The best currently available data, however, suggest otherwise.

## I. Methods and Style

The authors' stated approach is to examine the problems of power plant air pollution as if they were an "ideal New Deal agency charged with the task of selecting the most sensible means to congressionally approved ends—protecting health and environmental quality by cleaning up the air."[12] They suggest that the most sensible means are those that can be justified by good cost-benefit analysis.[13] Urging reversal of the 1979 stan-

Costle, No. 79-1565 (D.C. Cir. Apr. 29, 1981).

8. *See, e.g.*, 11 ENVIR. REP. (BNA) 2062, 2091, 2191, 2193 (1981); 12 ENVIR. REP. (BNA) 65, 275, 347 (1981) (discussions of possible amendments).

9. NATIONAL COMMISSION ON AIR QUALITY, TO BREATHE CLEAN AIR 3.7-3.8 (1981). This report cites Ackerman and Hassler's article to support this point.

10. Pp. 1521-36. Although the authors sometimes use the term "forced scrubbing" in a more general sense to refer to the mandatory use of scrubber technology, *see* pp. 1488-89, they use figures based on the EPA's proposed 1978 standard in their criticisms of "forced scrubbing," *see, e.g.*, p. 1524. We use the term to refer to the 1978 proposed standard.

11. P. 1525.

12. P. 1515.

13. *Id.*

dard, they conclude that "[c]riticism is properly due the agency for failing to relate its scrubbing decision to what the Act plainly requires: cleaning the air in a cost-effective way that yields real environmental benefits."[14] These statements strongly suggest that the authors base their substantive criticism of the agency's 1979 standard upon a careful cost-benefit analysis of the standard and alternatives to it,[15] and that such analysis clearly demonstrates that the 1979 standard is less cost effective. No such analysis exists. The authors did not conduct one, nor do they cite one in their article.[16]

The article suggests that the EPA failed to consider the regulation of power plant location as a method of air pollution control.[17] The authors completely ignore the agency's statutorily mandated "prevention of significant deterioration" (PSD) program, which requires a highly detailed siting and air quality analysis[18] for each new power plant and for every major modification to an old one.[19] The 1979 new source performance standard (NSPS) the authors criticize is simply one part of the overall statutory program, and is in fact the basis for control technology requirements under the PSD program.[20] The authors' narrow focus on "forced scrubbing" misses that important fact. The failure to discuss the PSD program is misleading to the reader, and leads the authors to discuss dispersion strategies of highly questionable legality or practicality.[21]

The legal analysis is flawed by similar omissions. Nowhere do the authors discuss the District of Columbia Circuit's "rigorous standard of review under section 111," under which the court engages in an in-depth review of the technical basis for the agency's choice of a new plant pollution standard. The leading case applying that standard, *National Lime Association v. EPA*, was decided months before the publication of the arti-

14. P. 1565.

15. The authors mention the following alternatives as preferable to "forced scrubbing" and, apparently, preferable to the EPA's 1979 standard: (1) the use of physically cleaned coal by old plants and low sulfur coal by new plants, pp. 1523-25; (2) the use of "market-like schemes" to decide among various control options, p. 1525; (3) the use of a "low ceiling" standard, uniform across the country, pp. 1526, 1544-45; (4) the use of "judicious site selection" and other siting alternatives, pp. 1530-31, 1534, 1538.

16. The agency analysis they cite shows that the 1979 standard is as cost effective as the "low-ceiling" option within the margin of uncertainty. The cost of the two alternatives is almost the same, and the difference of 200,000 tons in emission reductions is less than the margin of error in the model. *See* ICF INC., THE FINAL SET OF ANALYSES OF ALTERNATIVE NEW SOURCE PERFORMANCE STANDARDS FOR NEW COAL-FIRED POWERPLANTS 6 (June 1979) [hereinafter cited as ICF REPORT].

17. P. 1538.

18. Clean Air Act § 165(e)(3), 42 U.S.C. § 7475(e)(3) (Supp. III 1979).

19. *Id.* § 169(2)(c), 42 U.S.C. § 7479(2)(C); *see id.* § 111(a)(4), 42 U.S.C. § 7411(a)(4).

20. *Id.* § 169(3), 42 U.S.C. § 7479(3). When the EPA promulgated the 1979 standard, it explained that its models did not take into account the costs and benefits of the additional control measures required under PSD, including siting alternatives, because these depend on many site-specific factors that cannot be determined in advance. *See* 44 Fed. Reg. 33,580, 33,605 (1979).

21. *See* pp. 1409-10 *infra*.

cle.[22] This is a serious omission, because only the District of Columbia Circuit has the authority under the Clean Air Act to review standards promulgated under section 111.[23] Similarly, the authors ignore statutory limitations and existing case law when they argue that courts should endorse the EPA's efforts to permit polluters to offset pollution control requirements between old and new plants. They ignore a key issue under section 111 and the PSD provisions of the Act: what constitutes a modification to an old source.[24] They also ignore the two leading District of Columbia Circuit cases discussing that issue, *Alabama Power Co. v. Costle (I)* and *Alabama Power Co. v. Costle (II).*[25] In addition, the authors' suggestion that courts allow the EPA to regulate existing plants conflicts with their "principle of textual priority,"[26] because section 111 regulates only "new" or "modified" sources and not existing sources.[27]

Finally, Ackerman and Hassler fail to discuss air pollution control strategies and technology in dispassionate terms. Christening "forced scrubbing" as an environmental "peril,"[28] scrubbers as "technological symbols,"[29] and low sulfur coal as the "natural" method of compliance[30] may make for livelier reading, but it does little to advance the readers' understanding of these complex strategies and technologies.

## II. Substantive Analysis

The authors' substantive support is no match for their strong rhetoric. Although the article contains a number of assertions that we consider questionable, we shall focus on five that are central to their argument for reversal of the 1979 standard: first, the standard is environmentally counterproductive; second, a compliance strategy based on coal cleaning and low sulfur coal is far easier to enforce than one based on scrubbers; third, coal cleaning is far cheaper, faster, and more reliable than scrub-

22. National Lime Ass'n v. EPA, 627 F.2d 416 (D.C. Cir. 1980) (decided May 19). The article was published in early September 1980.

23. Clean Air Act § 307(b)(1), 42 U.S.C. § 7607(b)(1) (Supp. III 1979).

24. New source performance standards and PSD requirements regulate only new or modified sources, not existing ones. *Id.* §§ 111(a)(2), (4), 42 U.S.C. §§ 7411(a)(2), (4) (NSPS); *id.* §§ 165, 169(2)(c), 42 U.S.C. §§ 7475, 7479(2)(C) (PSD).

25. Alabama Power Co. v. Costle (II), 636 F.2d 323, 399-400 (D.C. Cir. 1979, published with slight modifications 1980); Alabama Power Co. v. Costle (I), 606 F.2d 1068, 1081 (D.C. Cir. 1979). Judge Leventhal joined in both opinions. The authors' failure to discuss the holdings concerning modifications in these two cases is a curious omission in light of their heavy reliance on Judge Leventhal's earlier decisions. *See* pp. 1558-59, 1568 n.404.

26. Pp. 1559-61.

27. *See* Clean Air Act §§ 111(a)(2), (4), 42 U.S.C. §§ 7411(a)(2), (4) (Supp. III 1979) (defining new and modified sources); *cf. id.* § 169(2)(c), 42 U.S.C. § 7479(2)(C) (applicability of PSD control requirements).

28. P. 1521.

29. P. 1530.

30. P. 1489.

bing and has no environmental drawbacks; fourth, scrubbers on new power plants will not effectively protect visibility in the West because of the air pollution emitted by Western smelters; and fifth, practical dispersion strategies can be used as an alternative to continuous emission control.

### A. *The Merits of the 1979 Standard*

A key count in the article's indictment of the 1979 standard is the assertion that the standard will make the environment worse in the areas east of the Mississippi suffering from acid rain.[31] The authors, however, devote very little attention to the standard actually adopted by the EPA in 1979.[32] Instead, they provide an extensive critique of "full scrubbing," that is, the use of wet scrubbers to remove ninety percent of the sulfur dioxide from power plant emissions.[33] The authors are attacking a straw man; "full scrubbing" was proposed by the agency in 1978, but it was not adopted by the agency in 1979.[34] The more flexible 1979 standard allows power plants that burn low sulfur coal to remove a lower percentage of their sulfur dioxide emissions, thereby enlarging the number of technological methods—including the use of dry scrubbers—available to comply with the regulation.[35] In no place in the proposed or adopted regulations is the use of any specific technology required, although the use of a number of new technologies[36] and anthracite coal[37] is deliberately encouraged. There are considerable differences between the initial proposal and the adopted standard, as might be expected after nine months of hotly contested notice-and-comment rulemaking and several million dollars of analysis by EPA personnel and respected consultants.

The authors present virtually no information about the emission reductions and environmental benefits projected to result from the 1979 standard that they criticize so strongly.[38] In fact, as shown by the EPA studies

31. P. 1469.

32. *See* pp. 1553, 1554 & nn.368-73, 1555 & nn.374-76.

33. *See* p. 1524 & n.234; ICF REPORT, *supra* note 16, at 4-5 (option M in ICF analysis); *id.* at C-VIII-21 (figures for alternative standard of 90% removal with washing credit; 1.0 pounds $SO_2$/MBTU ceiling; wet scrubbing). The 90% removal figure is an annual average. *Id.* at 4.

34. For projections based on the promulgated standard, see ICF REPORT, *supra* note 16, at C-III-21. The report clearly distinguishes between the two scenarios. *See id.* at 3-5.

35. *See* EPA, REVIEW OF NEW SOURCE PERFORMANCE STANDARDS FOR COAL FIRED UTILITY BOILERS: PHASE THREE REPORT 181-82 (1979) (EPA Pub. No. 600/7-79-215) (relaxation to permit dry scrubbing) [hereinafter cited as TEKNEKRON REPORT].

36. *See* 40 C.F.R. § 60.45a (1980). The commercial demonstration permit program allows 15,000 megawatts of new coal-fired generating capacity—about 7% of new capacity to be built by 1995—to meet more flexible pollution control requirements with the use of four promising control technologies and fuel pretreatment methods.

37. Changes were made in the final standard to promote the burning of low sulfur, low ash, high heat content anthracite coal from Pennsylvania. *See* 44 Fed. Reg. 33,580, 33,590 (1979).

38. The authors report that "some [unnamed] experts" claim that the data base on dry scrubbing

on which the authors rely, the 1979 standard results in substantially greater emission reductions east of the Mississippi than the 1978 proposal would have achieved.[39] In addition, compared to the 1971 standard, the 1979 standard reduces emissions in every area of the country, including the East, the South, and the Midwest,[40] which are all areas that contrib-

is weak. *See* p. 1555. Yet utilities have begun to build three full-scale plants that incorporate dry scrubbing technology. *See* TEKNEKRON REPORT, *supra* note 35, at 193 (boilers will come into operation in 1981 and 1982). Additionally, full-page advertisements are now appearing in trade publications drawing attention to the commercial availability and attractiveness of this new technology. *See, e.g.*, POLLUTION CONTROL ENGINEERING, Jan. 1981, at 15.

Large savings are projected to result from the use of dry scrubbing over the wet scrubbing required by the agency's initial proposal. Under the 1979 standard as adopted, the total capital costs between 1983 and 2000 are $48 billion, $34 billion cheaper than the 1978 standard the EPA proposed. *See id.* at 182. Moreover, the 1979 dry scrubbing standard is not substantially more expensive than the 1971 standard using wet scrubbing, with capital costs of $48 billion rather than $40 billion between 1983 and 2000. *Id.*

39. In the regions east of the Mississippi, the emission reductions are almost double those under the 1978 standard. *Compare* ICF REPORT, *supra* note 16, at C-III-21 *with id.* at C-VIII-21 (1,664,000 tons versus 958,000 tons). The difference is especially striking in the East North Central states (the Midwest in the authors' discussion), where a 171,000-ton emission *increase* under the proposed standard, *see* pp. 1524, 1535-36; ICF REPORT, *supra* note 16, at C-VIII-21, becomes a 186,000-ton emission *decrease* under the promulgated 1979 standard using dry scrubbing cost figures, *id.* at C-III-21.

Only by making the heroic engineering assumption that dry scrubbing costs will rapidly increase to wet scrubbing levels could the authors hope to justify their claim that emissions would increase slightly in the Midwest under the 1979 standard. *See id.* at C-IV-21. The ICF Report shows, however, that compliance with the agency's 1979 standard using dry scrubbing will be 32%—$1.2 billion—less costly per year than if wet scrubbing were used to meet the same standard. *Id.* at 2. The authors do not cite a single agency or utility industry report or expert opinion that would support the use of wet scrubbing cost figures to analyze the emission effects of the 1979 standard. In fact, more recent cost estimates continue to support the projected cost savings from dry scrubbing. *See* ICF INC., INTERIM RESULTS OF ACID RAIN MITIGATION STUDY, app. III, at III-11 (1981) (substantial cost savings of dry scrubbing over wet scrubbing in meeting equivalent standard) [hereinafter cited as ARMS REPORT].

40.

Comparison of 1971 Standard and 1979 Standard

| Region | Reduced Tonnage, 1979 Standard (000 tons) | Percentage Decrease |
|---|---|---|
| East | 1,054.9 | 14 |
| East North Central | 185.9 | 3 |
| East South Central | 423.1 | 12 |
| West North Central | 155.4 | 6 |
| West South Central | 918.7 | 35 |
| Mountain & Pacific | 629.7 | 37 |
| National Total | 3,367.7 | 14 |

Sources: ICF REPORT, *supra* note 16, at C-III-3a-3c (1979 standard); *id.* at C-I-3a-3c (1971 standard); *id.* at C-III-21 (reduction advantages of 1979 standard over 1971 standard).

This table shows the advantages of the EPA's 1979 standard over the 1971 standard. The year for comparison is 1995, the same year the authors used in their analysis. *See* p. 1524.

The trend shown by the ICF figures is confirmed by the agency's other major study of the likely

ute to and suffer from acid rain.[41] It is thus hard to see how the authors' attack on the 1979 standard is consistent with their concern for acid rain in these regions.

## B. *Enforcement Realities*

The article contends that "a universal scrubbing requirement threatens to overwhelm the existing enforcement system."[42] "[O]nce a realistic view of enforcement is taken," they assert, the EPA would find that "forced scrubbing may make the sulfate problem worse, not better,"[43] and "might dramatically worsen the East's sulfate problem."[44] These enforcement difficulties are peculiar to scrubbers, the argument runs. Monitoring is much easier, according to the authors, when power plants meet the 1971 standard "the natural way" with low sulfur coal or cleaned coal, allowing enforcement officials "to collect chunklets of coal for laboratory analysis."[45]

Continuous monitors, as required by the new standard, enjoy a statistical advantage over the fuel-sampling techniques favored by the authors. The monitors measure emissions from power plants far more frequently than is possible with small grab samples ("chunklets" of coal) from utility coal shipments.[46] It is basic statistics that accuracy increases with sam-

effects of the 1979 standard, a study the authors ignored. TEKNEKRON REPORT, *supra* note 35, at 187. Lowell Smith was the project officer managing this report. *See id.* at i.

41. Proper analysis of acid rain control strategies requires careful examination of emissions for the entire eastern half of the North American continent. *See* United States-Canada Memorandum of Intent on Transboundary Air Pollution: Atmospheric Modelling Interim Report 4-1 to 4-4 (Feb. 1981) (relevant area of concern from modeling perspective) (on file with *Yale Law Journal*); The LRTAP Problem in North America: a preliminary overview 33 (Oct. 1979) (report prepared by United States-Canada research consultation group) (map of sulfur dioxide emissions in eastern North America) (on file with *Yale Law Journal*). The authors focused too narrowly on emissions from the Midwest, *see* p. 1524, apparently on the assumption that only these emissions were important in acid rain problems. *See* p. 1524 n.235 (explaining away large emission reductions in Eastern, Southern, and Gulf states as insignificant). This assumption places the authors in the absurd position of arguing that their claimed 3% emission increase from Ohio, Indiana, and Illinois warrants reversal of the 1979 standard, despite a 12% decrease from other states east of the Mississippi. These other states include Kentucky, Tennessee, West Virginia, and Pennsylvania, some of the largest coal producing and consuming states in the country. In fact, however, the 1979 standard, assuming the use of dry scrubbing, will *reduce* projected Midwestern emissions. *See* note 40 *supra*.

42. P. 1526.

43. P. 1536.

44. P. 1539.

45. P. 1528.

46. Continuous monitors tend for this reason to give a far more accurate picture of actual emissions, even if the authors' gloomy view of continuous monitoring capabilities is correct. Interview with James Kilgroe, EPA Industrial Environmental Research Laboratory, Research Triangle Park, North Carolina (Mar. 11, 1981). Mr. Kilgroe is the coal-cleaning expert on whom the authors relied. *See* pp. 1481 n.55, 1523 nn.228-31, 1524 n.232.

Moreover, continuous monitoring of flue-gas sulfur dioxide is likely to improve substantially as mechanical problems with these devices are solved. On the other hand, fuel-sampling accuracy is likely to remain limited by the mathematical requirements and economic realities of sampling frequency, until monitors are developed that can *continuously* monitor the sulfur and ash level of coal.

pling frequency, especially when sampling values differ widely, as is the case with coal sulfur content.[47]

Continuous monitors enjoy another important advantage over fuel sampling. They give an instantaneous, "real-time" picture of actual emissions, information which permits rapid correction of problems.[48] In contrast, present fuel-sampling methods rely on daily average or ninety-day average fuel sulfur values and entail lags in data compilation.[49]

But the real difficulty with the authors' strategy may be human rather than technical: the use of low sulfur coal gives utilities and coal companies greater incentives to weaken or to violate standards. Where scrubbers are used, the utilities must continue to pay for them once they are built, whether or not they are used.[50] Sources in industry and the Justice Department confirm that once scrubbers are in place, utilities make conscientious efforts to stay in compliance and do not try to weaken the standard.[51] By the same token, when low sulfur coal is the compliance strategy, surreptitious use of higher sulfur coal can benefit utilities by lowering fuel costs substantially[52] and can benefit coal companies by increasing their profits.[53]

Interview with Kilgroe, *supra*.

47. *See* TEKNEKRON REPORT, *supra* note 35, at 6 (showing effects of coal sulfur variability and standard averaging time on "effective ceiling"); *id.* at 140 (range of sulfur contents in Western low sulfur coal from same seams); *id.* at 199 (definition of relative standard deviation of sulfur content in coal).

48. Present standards require a complete sampling cycle and analysis every fifteen minutes. 40 C.F.R. § 60.13(c)(1)(iii) (1980); *id.* § 60 app. B, at 460. The advantage of this real-time monitoring picture will be limited, however, unless utilities are also required to relay the information continuously to plant operators. At present, agency regulations do not require continuous monitoring or fuel-sampling data to be provided to plant operators.

49. Fuel sampling at coal-cleaning plants under current standards results in an average value for coal sulfur content for the lot of coal burned by the power plant over a 90-day period. *See* 40 C.F.R. § 60.344 app. A, at 431, ¶ 2.1.2 (1980). Although this period can be shortened, the large lot size normally produced by coal-cleaning plants will tend to limit the scope for improvement. Interview with Kilgroe, *supra* note 46. Under current standards, sampling at the power plant results in an average sulfur value for coal the plant burns over a 24-hour period. 40 C.F.R. § 60.344 app. A, at 432, ¶ 3.3 (1980). Smaller lot sizes at the power plant make the shorter averaging period practical. Interview with Kilgroe, *supra* note 46.

50. *See, e.g.*, ARMS REPORT, *supra* note 39, app. III, at III-12 (annualized capital costs substantially higher than operation and maintenance costs).

51. Interview with Russell Klier, PEDCo Environmental Specialists, in Cincinnati, Ohio (Jan. 6, 1977); interview with attorney, Pollution Control Section, Lands and Natural Resources Division, U.S. Department of Justice, in Washington, D.C. (Mar. 11, 1981).

52. Typically, low sulfur coal costs 20% more than high sulfur coal. *See* ARMS REPORT, *supra* note 39, app. III, at III-13 (listing delivered prices by sulfur content). Fuel costs are generally the largest operating expense of a coal-burning plant.

53. According to sources in EPA regional offices who are responsible for the enforcement of sulfur dioxide emission limitations, coal companies occasionally try to substitute cheaper, higher sulfur coal for the more expensive, lower sulfur coal the utilities are paying for. Interviews with a confidential source, one of ten EPA Regional Enforcement Offices (June 1980).

## C. *Coal Cleaning Capabilities*

The authors criticize the agency for failing to give sufficient consideration to coal cleaning, the physical removal of sulfur from coal before it is burned.[54] This method has significant promise in controlling some sulfur dioxide emissions, but it is not as cheap, as easy, or as rapid as the authors indicate, nor does their sketchy data support their inflated claims.

### 1. *Costs*

No direct evidence is cited to support the authors' claim that universal coal cleaning at old plants would result in significant savings over the scrubbing required at new plants under the 1979 standard.[55] Currently available data indicate otherwise. An interagency study by the TVA and the EPA clearly shows that, over a wide range of sulfur content, scrubbing and physical coal cleaning impose substantially similar costs for the removal of a pound of sulfur from an average coal of a given sulfur content.[56] In addition, figures generated by James Kilgroe, the EPA coal-cleaning expert on whom they rely, show that coal-cleaning costs range from $200 to $2800 per ton of sulfur dioxide removed.[57] If new power plants in these regions are required to install scrubbers and burn local coal, current estimates indicate that the costs would range between $330 and $1030 per ton of sulfur dioxide removed.[58] Moreover, whether coal cleaning or scrubbing is used, the cost per ton of sulfur dioxide removed tends to be lowest when sulfur content is highest, because the capital costs are distributed over greater emission reductions.[59] Consequently, when

54. Pp. 1523-25.

55. The claim of massive cost savings is made repeatedly. *See, e.g.*, pp. 1481, 1523, 1525.

56. EPA & TVA, EVALUATION OF PHYSICAL/CHEMICAL COAL CLEANING AND FLUE GAS DESULFURIZATION at xxiii (Nov. 1979) (EPA Pub. No. EPA-600/7-79-250) (annual revenue requirements for coal-cleaning processes and scrubbing).

57. Coal-cleaning costs for the Midwest and Northern Appalachian states (where sulfur content is generally high) ranges between $200 and $400 per ton of sulfur dioxide removed. *See* J. Kilgroe, Cost Effectiveness of Coal Cleaning in Four Regions (Aug. 1980) (unpublished EPA analysis) (table 15) (on file with *Yale Law Journal*). In contrast, cleaning costs in the Southern Appalachians—eastern Kentucky, Tennessee, southern West Virginia, and Virginia—range between $700 and $2800 per ton. *Id.* All these figures exclude tonnage and cost figures for metallurgical coal.

58. Costs range between $333 per ton of sulfur dioxide removed for a high sulfur coal typical of the Midwest (6.6 pounds $SO_2$/MBTU heat content) and $1,031 per ton for a lower sulfur coal typical of the coals available in the Southern Appalachians (1.66 pounds $SO_2$/MBTU). ARMS REPORT, *supra* note 39, app. III, at III-13.

The figures reported here actually overstate scrubber costs at new plants. They are based on the ICF Report figures available to the authors, adjusted for inflation to 1980 dollars, and raised by 30% in order to give current costs for retrofitting large existing power plants, a more expensive proposition generally than installing scrubbers at new plants. ARMS REPORT, *supra* note 39, app. III, at III-5.

59. *See* TEKNEKRON REPORT, *supra* note 35, at 41 (cost effectiveness of scrubbing increases with sulfur content of coal burned). The cost effectiveness of coal cleaning tends to be more complicated, because it depends heavily on the physical distribution of pyritic sulfur in the coal seam, as well as the overall sulfur content.

coal cleaning is cheap, scrubbing tends to be; when scrubbing is expensive, coal cleaning tends to be either expensive or impossible.[60]

These cost figures are all quite tentative, but they do show that coal cleaning does not enjoy the pronounced advantages claimed by the authors, and that scrubbing may be more cost effective in many cases.[61] Although these cost figures need considerable refinement—now in progress—the estimates reported here are far better supported than those used by the authors to advocate reversal of the 1979 standard.[62]

### 2. *Speed*

The article contends that coal cleaning would achieve faster emission reductions than the 1979 standard.[63] The evidence for these claims is thin: an estimate of the time needed to build one coal-cleaning plant, and a projection that one to two million tons of additional emission reductions could have been achieved by 1985 if the EPA had launched a crash program in 1980.[64] This estimate did not include the time needed for the EPA to develop, to propose, to promulgate, and to implement regulations that would require universal washing practices, a process that could take more than five years.[65]

60. Thus the costs of cleaning higher sulfur coal from the Midwest and Northern Appalachians range between $200 and $400 per ton of $SO_2$ removed; the cost of scrubbing emissions from a plant burning a coal typical of the region (6.6 pounds $SO_2$/MBTU) is $333 per ton of $SO_2$ removed. ARMS REPORT, *supra* note 39, app. III, at III-13. Scrubbing the lowest sulfur coal is most expensive per pound of sulfur removed. However, coal cleaning may be an ineffective control technique for these coals, because Western low sulfur coals are very low in pyritic sulfur and therefore not susceptible to cleaning. Plants burning low sulfur coal from the Southern Appalachians will generally find scrubbing more cost effective than cleaning. Interview with Kilgroe, *supra* note 46.

61. Cost ranges for coal cleaning and scrubbing for each region tend to be fairly close. *See* notes 57, 58, & 60 *supra*. The authors' failure to account for the differences between the regions lead them to compare cleaning costs on Eastern coals, *see* J. Kilgroe, *supra* note 57 (table 15), with a range of scrubber costs that includes the scrubbing of low sulfur Western coals, p. 1523 & n.231, much more expensive per ton of $SO_2$ removed than the scrubbing of Eastern or Midwestern coals. *See* ARMS REPORT, *supra* note 39, app. III, at III-13 ($2000 per ton for wet scrubbing 0.8 pounds $SO_2$/MBTU coal; $1504 for dry scrubbing); *cf.* note 57 *supra* (cost of scrubbing higher sulfur coal). Little coal cleaning is done in the West, in part because the process has little capacity for removing sulfur from Western coals. *See* note 60 *supra*.

62. The documents cited here adjust cost and tonnage figures in order to exclude metallurgical coals, and break down cleaning and scrubber costs by region and sulfur content of the coal. *See* ARMS REPORT, *supra* note 39, app. III, at III-12 (differences in scrubber cost by coal sulfur content); J. Kilgroe, *supra* note 57 (table 15) (adjusting for metallurgical coals and regional variations); *see* note 57 *supra* (cost figures).

63. P. 1525.

64. *See* p. 1524. If all utility coal east of the Mississippi not currently cleaned were to be cleaned, the maximum additional emission reduction would be 2.37 million tons of sulfur dioxide for coal used in 1985. *See* J. Kilgroe, *supra* note 57 (table 16). That is *not* an estimate of when such reductions could be achieved. Interview with Kilgroe, *supra* note 46.

65. Kilgroe's April 1980 estimates and those of Versar, Inc. in May 1980, both relied upon by the authors to support their claims for one to two million tons of additional emission reduction, *see* p. 1524 n.232, both assumed that all regulatory obstacles and other barriers to coal cleaning had been overcome. Interview with Kilgroe, *supra* note 46 (Kilgroe was agency project officer for Versar Re-

In actual fact, additional emission reductions from coal cleaning before 1985 are likely to be severely limited, because present excess coal-cleaning capacity is less than twenty percent of the additional capacity needed to clean all utility coal east of the Mississippi.[66] Consequently, a number of new plants will have to be built before the reductions promised by the authors can be achieved by coal cleaning. That construction might well delay these reductions into the 1990s, a date supported by the best recent estimates.[67]

### 3. *Environmental Problems of Coal Cleaning*

Coal-cleaning plants can cause significant air and water pollution and disposal problems for large quantities of potentially dangerous solid wastes.[68] We believe that these difficulties can be controlled, but we do not understand why the authors think so, given their gloomy view of EPA enforcement. No reason is cited for their assumption that enforcement at

port). Substantial regulatory and market structure barriers to coal cleaning exist. *See* Office of Energy, Minerals, and Industry, U.S. Environmental Protection Agency, The Federal Program in Coal Cleaning (Aug. 29, 1977) (agency study on which Randle and Kilgroe collaborated) (on file with *Yale Law Journal*).

66. Interview with Kilgroe, *supra* note 46 (estimate of present idle capacity). Coal-cleaning capacity for 1985 is currently estimated to be about 200 million tons per year for utility coal; annual utility coal production east of the Mississippi is estimated to be about 505 million tons. *See* J. Kilgroe, *supra* note 57 (table 16). The data base on the removal efficiencies of this estimated capacity is very thin. Due to limited data on the effectiveness of currently installed equipment, no reliable estimates are available on the gross sulfur removal capabilities of this equipment.

67. Interview with Gregory Wetstone, Environmental Law Institute, in Washington, D.C. (Mar. 27, 1981) (delay until 1990 for one to two million ton reduction likely, due to need for new construction and normal utility response time). Mr. Wetstone is one of the authors of G. Wetstone & P. Reed, Institutional Aspects of Transported Pollutants: An Examination of Strategies for Addressing Long Range Air Pollution Problems, Report to the National Commission on Air Quality (1981) (copy on file with *Yale Law Journal*). According to that report, even if Congress specially authorized a coal-cleaning requirement such as the authors advocate, "the full benefits associated with this program may not be realized until as long as 11 years after Congressional authorization," even though some air quality benefits "may begin to accrue 3 years after passage of the authorizing legislation." *Id.* at 46. These estimates are based on "past experience with comparable programs," with the following time estimates for each step: (1) development and promulgation of regulations, one to four years; (2) state implementation plan revisions, including a phase-in for construction delay, two to four years; (3) source compliance, including time to upgrade old plants and build new capacity, zero to three years. *Id.* at 46-47.

Mr. Wetstone believes that, for any substantial reduction, the eleven-year time frame is more realistic because the three-year estimate assumes that utilities would begin construction of substantial coal-cleaning capacity while the EPA develops regulations. Interview with Wetstone, *supra*. However, the normal utility practice is to wait until the EPA has finished framing its regulations and then to begin placing the necessary construction and equipment orders. *Id.* Moreover, the short time estimate assumes that there would be no construction delays as a result of a sudden surge in demand for coal-cleaning equipment. *Id.* In reality, some delay is likely because of shortages and other problems that can be expected in any kind of crash program. *Id.*

68. *See* 40 C.F.R. § 60.252 (1980) (air pollution standards for new coal-cleaning plants); *id.* § 434.20-.25 (water pollution standards for coal-cleaning plants); EPA, ENVIRONMENTAL ASSESSMENT OF COAL CLEANING PROCESSES: TECHNOLOGY OVERVIEW 47-48 (Sept. 1979) (EPA Pub. No. EPA-600/7-79-073e) (discussion of solid waste disposal problems of coal-cleaning plants).

coal-cleaning plants will be better than the authors claim it is at power plants. Had they been consistent in their enforcement assumptions, the authors would not have advocated a headlong rush to coal cleaning and reversal of the 1979 standard.

D. *Visibility Protection*

The authors contend that it is irrational to spend "billions of dollars" on scrubbing in the Western states in order to protect visibility, because air pollution from smelters will mask any changes in regional visibility,[69] and because "beefed-up enforcement" and better siting will alleviate the "plume effects" from individual plants.[70]

The authors' argument on regional haze problems apparently assumes that new power plants will be concentrated in the two Western states most strongly affected by air pollution from smelters: Arizona and New Mexico, the homes of nine large copper smelters. In fact, most new power plants projected to be built in the Western states, which now enjoy high visibility, are slated for Colorado, Idaho, Montana, Nevada, Utah, and Wyoming,[71] which currently have five smelters among them. Consequently, the failure to control emissions from power plants in these states with high visibility poses a substantially greater risk of creating regional haze problems than the authors' discussion would indicate.[72]

The authors' arguments on the use of power plant siting and enforcement to alleviate plume effects also miss the mark. As previously noted, the EPA's PSD program, mandated by the Clean Air Act, is a siting program. A central feature of the PSD program is its stringent standards for power plants located near national parks and wilderness areas, standards designed to prevent adverse effects on visibility in those areas.[73] Similarly, increased enforcement in the West would result in little emission reduction, because EPA enforcement of power plant emission limitations is considerably more effective than the authors' discussion indicates, especially

69. Pp. 1534-35.

70. P. 1534.

71. According to ICF projections, more than 70% of the new coal-fired generating capacity built in the eight-state region by 1995 will be located in these six states. *See* ICF REPORT, *supra* note 16, at C-III-8e to -8f (21,701 megawatts out of 29,828 megawatts of new capacity).

72. Continuation of the 1971 standard would allow power plant sulfur dioxide emissions in the Mountain region to increase from 358,000 tons in 1975 to 1,231,600 tons in 1995. *See* ICF REPORT, *supra* note 16, at C-I-3b. The EPA's 1979 standard reduces the 1995 level to 839,000 tons. *Id.* at C-III-3b. Under either standard, most of the increases in coal-fired generating capacity and the resultant emission increases are projected to occur outside Arizona and New Mexico, the states with the bulk of smelter sulfur dioxide emissions.

73. *See* Clean Air Act §§ 162-163, 42 U.S.C. §§ 7472-7473 (Supp. III 1979) (stringent air quality standards for mandatory Class I areas, including national parks larger than 6,000 acres and national wilderness areas larger than 10,000 acres).

when enforcement is based on scrubbers.[74]

### E. *Dispersion Techniques*

The authors advocate reductions in stack height and changes in operating regimen to concentrate sulfur dioxide emissions near power plants, thus supposedly alleviating acid rain problems in the East and plume effects on visibility in the West.[75] The result of this effort to reduce atmospheric dispersion of harmful pollutants, however, would be to increase ambient concentrations of sulfur dioxide and the depositional loads in the area of each emitting source. Yet avoiding the adverse effects associated with these concentrations has required the attention of Congress, the agency, and industry over the past decade. Indeed, the authors have provided no evidence that an appreciable fraction of large sulfur dioxide emitters currently operating or proposed for construction would be able to use short stacks without creating serious violations of air quality standards or without exceeding the allowable PSD increments. The PSD increments are particularly stringent near national parks and wilderness areas in the West.[76]

Avoidance of excessive concentrations of sulfur dioxide and avoidance of adverse depositional loads of sulfate requires either increased dispersion or emission reductions. Section 123(b) of the Clean Air Act flatly forbids the use of dispersion techniques in lieu of continuous emission controls.[77] The authors have failed to consider the second horn of the practical dilemma that confronts them.

## Conclusion

Our purpose in writing is limited, but highly relevant to the validity of the authors' philosophical arguments. Much of their article attempts to demonstrate the supposed environmental and economic irrationality of the 1979 standard the EPA adopted, thus proving the need for reversal by the courts and Congress and the validity of the administrative law principles they sketch. As should be apparent to the reader, our purpose is primarily to show that serious technical and methodological problems in the case study leave their arguments unsupported.

We have grave reservations about other aspects of the article, particularly the authors' glaring lack of consideration of serious long-term supply limitations in the low sulfur coal market, and the increasingly heavy de-

74. *See* pp. 1404-05 *supra*.
75. *See* pp. 1531, 1534.
76. Clean Air Act §§ 162-163, 42 U.S.C. §§ 7472-7473 (Supp. III 1979).
77. *Id.* § 123(b), 42 U.S.C. § 7423(b).

mands that other industrial users are placing on this low sulfur fuel. We also note that the authors ignored the serious effects of nitrogen oxides on both acid rain and visibility. Space limitations prevent us from examining these and several other serious problems, but the authors' fundamental analytic failures make it unnecessary for us to do so in this comment.

These problems highlight our basic differences in approach. Not only does their approach overstate problems with present strategies and technologies, but it causes them to assume that a market scheme would avoid most of these pitfalls. Market schemes must depend on the same family of technological and fuel options, and the same kind of enforcement personnel and monitoring technologies, that present rules rely on. They must address the same complex problems of atmospheric chemistry and physics. They must contend with the same political and economic interests in Congress, the states, the affected industries, and the environmental movement. The invocation of slogans such as "market-like schemes" alters none of the technical, human, physical, and political realities, and is simply a masquerade for serious analysis. Serious analysis seldom yields answers as easy as the authors claim and, in this case, leaves their theories entertaining, but unproven.