Clean Air: From the 1970 Act to the 1977 Amendments

Samuel Hays

Clean Air: From The 1970 Act To The 1977 Amendments

*Samuel Hays**

Introduction

Passage of the 1977 amendments to the Clean Air Act[1] came after seven years of intense experience with the workings of the 1970 law. There was continual litigation, both to restrain and to enhance the application of the former Act, the outcome of which established an evolutionary tone. There was continual evaluation of the process of implementation, and especially of enforcement, creating a changing set of ideas about what would bring results and what would not. Underlying this were both changing public values as to what objectives were desired in a clean air program and an evolving body of information and concepts about the phenomenon of air pollution itself. The significance of this debate was reflected in the intensity of the three-year controversy over the amendments. Our purpose is to provide an historical understanding of the manner by which the program established by the Act of 1970 evolved into the amendments of 1977[2]

From the point of view of those intimately involved in the workings of the Act of 1970, it established an extremely complex setting, often difficult to grasp due to the sheer weight of detail. There were stationary sources and mobile sources; different programs for the six different criteria pollutants; old sources and new sources; and special provision for hazardous pollutants. There were responsibilities for federal agencies and for state agencies. In addition, there were the more technical details of emission inventories and air modeling,

* The author received a B.A. degree from Swarthmore College in 1948; a M.A. from Harvard University in 1949; and a Ph.D from Harvard University in 1953. He is presently a Distinguished Service Professor of History at the University of Pittsburgh. This article is adapted from a speech delivered by Professor Hays, March 1978, in a program entitled Environmental Issues of the Pittsburgh Region — Clean Air Amendments in Western Pennsylvania, sponsored by the Carnegie Museum of Environmental History.

1. Clean Air Act Amendments of 1977, Pub. L. No. 95-95 (codified in scattered sections of 42 U.S.C.A. §§ 7401-7642 (Supp. 1977)).

2. For background to the 1970 Act, *see, e.g.*, J. C. Davies, III, The Politics of Pollution (1970); J. C. Esposito, Vanishing Air (1970); and R. H. K. Vietor, Environmental Politics of the Coal Industry 240 (doc. diss., U. of Pitt., 1975).

the calculation of credits for tall stacks, the assessment of the state of technology to determine both what innovations might be brought into being and what could not. Amid such details engineers began to live in different worlds from lawyers,[3] the sellers of pollution-control equipment had to negotiate with buyers,[4] and citizens who sought to become involved in decision-making found ways and means of influencing the program despite its complexities.[5]

This world of complex detail, however, can be misleading. In many respects the entire clean air program is extremely simple; and it is important, as a starting point of analysis, to return to those basics. The clean air effort consists of two elements: standards and implementation. The identical issue is how clean the air should be. Any environmental quality program involves a desire either to clean up the air, water, or land, or to prevent its degradation. The problem lies in the degree of cleanness. To be effective, the general concern must be translated into an operating procedure, a performance standard, an acceptable practice on the part of individuals, corporations or government. Much of the debate has been, and continues to be, over that question. While, to the general public, a standard represents a higher qualitative level of living, to the polluter it represents a cost which reduces both the profits of a private corporation and the budgets of a public enterprise.

Standards constitute only the first step; the second step is implementation. How can the current circumstances be made more desirable? How can a currently desirable condition be prevented from becoming an undesirable one in the future? The effectiveness of implementation reduces or maintains the standards. To hold to the avowed level of quality is a constant challenge. Those whose behavior implementation seeks to change will continually strive to reduce the standards, to claim "overregulation," to argue that implementation goes beyond the intended objectives, to postpone, and thereby to reduce, the impact of regulation. Implementation can become less effective if it is open-ended, with a loose schedule for producing results, or it can become highly controlled with a firm

3. *Compare* the technological perspective on air pollution problems which is found generally in J. AIR POLLUTION CONT. A. and ENVT'L. SCI. & TECH. *with* the legal perspective which is found in ECOLOGY L.Q., ENVT'L. L., and ENVT'L. AFF.

4. *See* G. B. Irwin, *In Defense of the Vendors*, 9 ENVT'L. SCI. & TECH. 534-36 (June 1975).

5. *See generally* REPORTS OF NATURAL RESOURCES DEFENSE COUNCIL AND RELEASES OF NATIONAL CLEAN AIR COALITION for information on citizen action in clean air issues.

timetable accompanied by the requirement of intervening steps involving specific accomplishments. Despite all these complexities, however, implementation is a simple problem of practical results.

This analysis outlines the major elements of the clean air program in terms of their conceptual content rather than their complexity of detail. We will attempt to avoid the tendency to recount the specifics of the law and its administration and will, instead, provide the reader with some sense of balance and proportion in comprehending the various ingredients of the program.

THE STANDARDS OF THE ACT

The Clean Air Act of 1970 established a dual set of primary and secondary standards.[6] Primary standards were built around the concept of protecting public health; secondary standards were intended to protect a variety of social conditions, collectively known as "public welfare," but more precisely outlined as the effects on materials, agricultural production, ecosystems and aesthetics such as visibility. Thus the Act intended a wide range of effects to inform the objectives of the air quality program, not confined to health effects, but extending to many other adverse pollution problems. There were to be minimum national standards established by federal authority which, in turn, would be implemented by state agencies.

Administration of the Act, however, resulted in a selective approach to this broad mandate. First, administrative decisions confined the application of the authority of the 1970 Act to six "criteria pollutants";[7] only under legal challenge from citizen groups did the Environmental Protection Agency take steps to include other pollutants, the first of which was lead.[8] The 1977 amendments instruct

6. For a review of the Act of 1970 and its early implementation, see 4 ECOLOGY L.Q. 441 (1975), the entire issue of which is devoted to the subject. A manual detailing the workings of the Act, from the viewpoint of potential citizen involvement, is J. CANNON, A CLEAR VIEW (1975).

7. The six criteria pollutants are: sulfur oxides, particulates, carbon monoxide, photochemical oxidants, hydrocarbons, and nitrogen oxides. *See* 40 C.F.R. §§ 50.4-50.11 (1976).

8. Action to force development of a lead standard was brought by the Natural Resources Defense Council in 1971; on March 31, 1976, EPA listed lead as a criteria pollutant and proceeded to develop a criteria document and standard. The sequence of events and the controversies over formulation of the criteria document may be followed in 7 ENVIR. REP.—Current Dev. (BNA) 1361 (Jan. 14, 1977), 1486 (Feb. 4, 1977), 1962 (Apr. 22, 1977); 8 ENVIR. REP.—Current Dev. (BNA) 274 (June 17, 1977), 409 (July 8, 1977), 929 (Oct. 14, 1977).

EPA to consider four specific additional pollutants.[9] The history of the federal clean air program indicates that the regulatory agency was well aware of the desirability of a much broader perspective. Under the preceding Act of 1967,[10] which required the states to set standards and to implement them, the federal National Air Pollution Control Administration commissioned a study by Litton Industries to decide which pollutants it should bring within its purview.[11] The 27-volume report, which covered the health effects of 30 pollutants, was submitted in September, 1969. It is apparent that NAPCA contemplated issuing criteria documents for more than the initial six, since it announced schedules for their appearance during 1969-1970. In establishing a program, however, the successor agency, the EPA, did not take the initiative to expand coverage beyond the six "criteria pollutants."

Also, the secondary standards have not been enforced so strictly as the primary ones, especially in the case of sulfur dioxide. One could argue that the entire clean air program has been influenced overwhelmingly by health effects and, in the process of day-to-day administration, agencies slowly drifted toward a preoccupation with the correction of health problems to justify an action. One of the first major judicial decisions involved a challenge by the smelting industry to the secondary sulfur dioxide annual average standards. The case was remanded by the court to the EPA for further consideration, and it has never reemerged.[12] Visibility as a specific element of an aesthetic air quality standard was not taken seriously by EPA. It did appear in a number of state programs, and the 1977 amendments explicitly incorporated visibility into the federal program for most national parks and wilderness areas.[13] Thus, the 1977 amend-

---

A brief summary of the issues from an environmental viewpoint is contained in H. L. NEEDLEMAN & S. PIOMELLI, THE EFFECTS OF LOW LEVEL LEAD EXPOSURE (1978).

9. 42 U.S.C.A. § 7422(a) (Supp. 1977). The statute lists: "radioactive pollutants (including source material, special nuclear material, and byproduct material), cadmium, arsenic and polycyclic organic matter . . . ." *Id.*

10. An excellent account of the climate of change between these two acts is contained in House Comm. of Interstate and Foreign Commerce, Clean Air Act Amendments of 1977, H. R. REP. No. 294, 95th Cong., 1st Sess., *reprinted in* [1977] U. S. CODE CONG. & AD. NEWS 1077.

11. *See* ESPOSITO, *supra* note 2, at 162, for events surrounding the Litton reports.

12. *See* Kennecott Copper Corp. v. EPA, 462 F.2d 846 (D.C. Cir. 1972).

13. The relevant section is 42 U.S.C.A. § 7491 (Supp. 1977). National Park Service analysis of visibility in parks in southern Utah, as affected by existing and proposed generating plants, helped to focus the concern for this provision. *See* U. S. DEPT. OF THE INTERIOR,

ments attempted to capture a broader spectrum of objectives in standard setting, as originally outlined in the 1970 Act.

Third, some states established standards of maximum allowable pollution levels which were lower than the federal standards. The 1970 Act permitted this for stationary sources, clearly indicating that the federal levels were to be a minimum effort and that states were not prohibited from setting them lower. Some states have done so,[14] and challenges by industry to such state discretion have been rejected by the courts on a number of occasions.[15] Few states, however, have utilized this option. The Act of 1970 witnessed an intense controversy concerning state discretion with respect to mobile sources. Despite massive opposition from the automobile industry, California waged a long and successful battle to secure authority to establish allowable automobile emission levels lower than federal levels.[16] No other state has secured that option. The 1977 amendments extended the alternative to other states as well.[17]

State discretion in standard setting for the evolution of the clean air program permits some experimentation beyond the federal minimal requirements. It would be easy for the federal program to become frozen into established patterns, thereby creating a barrier to innovation. In fact, regulated industries tend to promote such rigidity. The clean air program, however, contains a dynamic element of new experience, new knowledge and new public values. It is important to observe the degree to which administrative agencies either resist or incorporate these evolving circumstances external to administration itself. There appears to be a natural tendency to do things the old way and to resist the implications of innovations in perspective. State freedom to innovate provides some countertendencies to this conservatism. Flexibility does not guarantee innovation, since states also need resources, such as a firm research base

---

NATIONAL PARK SERVICE, ANALYSIS OF KAIPAROWITZ POWERPLANT IMPACTS ON NATIONAL RECREATION RESOURCES WITH INTERIOR REVIEW COMMENTS ATTACHED (March 1976).

14. The federal 24-hour standard for sulfur dioxide, for example, is 0.14 ppm. Several states have standards in the range of 0.10 to 0.13 ppm, and seven states have standards below 0.10 ppm. These include Hawaii with 0.03 ppm, Colorado and California with 0.05 ppm, Vermont with 0.06 ppm, Missouri with 0.07 ppm, and Maine and Georgia with 0.09 ppm.

15. The relevant section is 42 U.S.C.A. § 7411(c) (Supp. 1977). This state authority was contained in the 1967 Act and was upheld in Houston Compressed Steel Corp. v. State of Texas, 456 S.W.2d 768 (Tex. Civ. App. 1970).

16. For a recent account of the California issue, see J. E. KRIER & E. URSIN, POLLUTION AND POLICY (1978).

17. *See* 42 U.S.C.A. § 7411(c)(1) (Supp. 1977).

to bolster legal argument to act independently. The California experience, however, is instructive. While the federal 24-hour particulate standard is 260 ug/m3,[18] the California standard is 100 ug/m3. While the federal 24-hour sulfur dioxide standard is .14 ppm,[19] the California standard is .05 ppm when both oxidant and particulate levels are at the maximum 24-hour allowable.[20] The regulated industries may not appreciate such increasingly stringent standards since these serve as examples which other states might be tempted to follow.

A fourth aspect of the standards is whether or not they should go beyond primary and secondary levels to the entire range of air quality in every area of the nation. This issue, in the form of the "prevention of significant deterioration" (PSD) program, became one of the most heated controversies in the years between 1970 and 1977. Environmental groups, led by the Sierra Club, argued that the Act of 1970 required a program to prevent the deterioration of air cleaner than the secondary standards.[21] The issue was debated intensely during administrative rule-making in 1971 and, when no instructions were provided to the states to establish a PSD program in the guidelines, litigation ensued. The resulting court decision upheld the environmentalists' argument and led to EPA regulations and an explicit program spelled out in the 1977 amendments.[22] The most significant effect of all this was to extend the clean air program from the cities to the entire countryside and to establish maximum allowable levels of pollution in every area of the nation. While the Act of 1970 limited the explicit standards to certain areas of the country, the 1977 amendments extended them to all areas.

Standard setting under the 1970 Act required a rationale and a data base to provide support for the chosen level. Thus, the health standard must be based on information about health effects, to determine the precise level of pollution beyond which adverse ef-

18. *See* 42 U.S.C.A. § 7474 (Supp. 1977).

19. *Id.*

20. *See* note 14 *supra.*

21. For a good account of the early development of the "no significant deterioration" program, as it was initially called, see T. M. Disselhorst, Sierra Club v. Ruckelshaus, 4 ECOLOGY L.Q. 739 (1975).

22. *See* Sierra Club v. Ruckelshaus, 344 F. Supp. 253 (D.D.C. 1972). For the EPA regulations, which were promulgated Dec. 5, 1974, see 40 C.F.R. § 52.21 (1974). For an analysis of the PSD problem, see 1977 U.S. CODE CONG. & AD. NEWS 1181-1257. For an extensive review with bibliographies, see A. C. Stern, *Prevention of Significant Deterioration,* 27 J. OF THE AIR POLLUTION CONT. A. 440 (1977).

fects on human health occur. Similar information is required for "welfare" effects, such as data about the effects on materials, crops and visibility. The 1970 Act, following innovations in the former Clean Air Act of 1963 and the Air Quality Act of 1967, provided for the compilation of "criteria documents"—summaries of the available scientific information on air pollution effects. These were to establish the basis upon which standards would be set, by first determining the level of observable adverse effects and then reducing that level further by a "margin of safety" factor. For "welfare effects," no such margin of safety was provided in calculating the standard.[23]

The initial point of controversy in standard setting arose from the conclusions about environmental effects in the criteria documents. If one wishes to protect health and can establish that adverse effects cannot be observed lower than 360 micrograms per cubic meter of particulates, then far less clean-up will be required than if those adverse effects can be observed at 120 micrograms per cubic meter. Debate over the summaries of research for health effects mounted during the late 1960's. When the National Air Pollution Control Administration developed the initial criteria document for sulfur oxides early in 1967, the coal industry raised such intense protest that in the 1967 law Congress directed the Administration to reexamine the evidence.[24] During the debate over the 1970 Act and the ensuing standard setting for both old and new sources in 1971, many industries testified concerning their conclusions about the scientific data on health effects. The conclusions varied greatly, depending, for the most part, on the degree to which clean-up would be required in that particular industry.[25]

For a number of years, the original criteria documents remained unmodified. At the same time, the Act of 1970 had stimulated an extensive amount of scientific information far beyond that available in the late 1960's, when the documents were formulated. As a result, in 1976 the Air Quality Criteria Advisory Committee of the EPA recommended that the documents be revised. A schedule was estab-

23. This was a major point at issue in the argument of the plaintiffs in the *Kennecott Copper Corp.* challenge of the secondary sulfur dioxide standard. Kennecott Copper Corp. v. EPA, 462 F.2d 846, 849 n.13 (D.C. Cir. 1972).

24. ESPOSITO, *supra* note 2, at 280.

25. *See* Vietor, *supra* note 2. The American Mining Congress recommended a sulfur dioxide annual average standard of 130 ug/m3; the American Petroleum Institute, 115 ug/m3; and the American Smelting and Refining Company, 2-5 ppm.

lished for all six "criteria pollutants," which initially involved completion of revision by the end of 1979. Later, the date was extended to 1980.[26] The amendments of 1977 establish a periodic schedule for revision, and explicitly require that a nitrogen dioxide criteria document for short-term exposure be issued not later than six months after enactment. In authorizing this revision, Congress was explicit about the range of effects to be considered: "nitric and nitrous acids, nitrites, nitrates, nitrosamines, and other carcinogenic and potentially carcinogenic derivatives of oxides of nitrogen."[27]

Controversy over the criteria documents and their conclusions is not over. Perhaps it is just beginning. Revision now underway will provide a major opportunity for all sides to the controversies, especially those wanting higher allowable contaminant levels and those wanting lower, to reopen the issues fully. This controversy will be even more intense precisely because all parties are far more aware now of the critical importance of the summaries of the scientific data and particularly because environmentalists are far better prepared to bring their case to bear on the evaluations of the scientific evidence. The stakes are high for both improved environmental quality, on the one hand, and costs to polluters, on the other. The outcome of the wider debate over air quality programs rests, more than anything else, on the outcome of the debates over the state of scientific knowledge about environmental effects.

Some of the more generic controversies are significant. First is the question of the admissible types of evidence. Are toxicological studies of effects of pollutants on animals acceptable grounds for drawing conclusions about effects on human life? Medical experts are divided on this issue. Do epidemiological studies, complex statistical analyses of the relationship between the incidence of environmental pollutants and environmental effects, provide sufficient basis for making judgments about the causal relationship between the two? Some medical experts argue that the relationships are so complex and impossibly confused that no sound conclusions can be drawn; others argue that, in spite of this, the weight of the evidence does establish an acceptable basis for action. Also, there are arguments over what populations should be taken into account in de-

26. *See* 6 ENVIR. REP.—Current Dev. (BNA) 1393 (Dec. 12, 1975), 1993 (Mar. 26, 1976); 7 ENVIR. REP.—Current Dev. (BNA) 12 (May 7, 1976), 127 (May 28, 1976), 464 (July 16, 1976), 924 (Oct. 22, 1976).

27. 42 U.S.C.A. § 7408(c) (Supp. 1977).

scribing health effects: the healthiest segment of mature adults or the more susceptible groups, such as the very young, the very old, and the chronically ill. Finally, there are arguments regarding the actual quantitative relationships, such as that between the level of lead in blood and the level in the ambient air.[28]

In such matters as these, medical experts' opinions range along a spectrum. On one end are the "hard liners" who argue that conclusive proof of harm should be established before action is justifiable; on the other are those "health protectionists" who argue that "substantial risk" can be established when "conclusive proof of harm" cannot, and that the purpose of environmental protection is to reduce such risk. This range of opinion about the degree of proof required before conclusions can be drawn is a rather common phenomenon among scientists and is not peculiar to environmental effects analysis.[29] It can be expected, therefore, that the controversies will continue. As long as the public has differences of opinion about the degree of environmental quality which is desirable, and scientists disagree concerning the "degree of required proof" to justify different levels of regulation and control, the controversies will persist.

Deep debate over interpretation of health effects continues. Recently the steel industry, through the American Iron and Steel Institute, petitioned the federal courts to require EPA to revise the criteria document for particulates more rapidly than scheduled.[30] Underlying this action is the steel industry's own "criteria document" about the environmental effects of particulates. It was drawn up by eight British medical experts under the lead authorship of Dr. W.W. Holland, Professor of Clinical Epidemiology and Social Medicine at St. Thomas Hospital Medical School of London.[31] The Holland document discounts the reliability of both toxicological studies on animals and epidemiological analyses of chronic health effects as a basis for drawing conclusions about human health effects and stan-

28. For controversies concerning workplace carcinogens, see 42 Fed. Reg. 54,148 (1977). *See also* N. KARCH, EXPLICIT CRITERIA AND PRINCIPLES FOR IDENTIFYING CARCINOGENS, DECISION MAKING IN THE ENVIRONMENTAL PROTECTION AGENCY (NAS, Analytical Studies for the U. S. Environmental Protection Agency, vol. IIa). For the lead relationship dispute, see 7 ENVIR. REP.—Current Dev. (BNA) 1486 (Feb. 4, 1977).

29. *See* J. P. Hills, *Legal Decisions and Opinions in Pollution Cases,* 10 ENVT'L. SCI. & TECH. 234 (1976).

30. 8 ENVIR. REP.—Current Dev. (BNA) 1507 (Feb. 3, 1978).

31. W. W. Holland, Health Effects of Particulate Pollution: Reappraising the Evidence (Preliminary) (Dec. 1, 1977) n.p.

dards. It argues that the current particulate annual average standard of 75 ug/m3 can safely be doubled to 150 ug/m3. Such arguments do not go unchallenged in the environmental health and regulatory fields. For example, California's own criteria documents, supported by medical opinion in that state, take a very different tack. The American Petroleum Institute has made a similar challenge of the current oxidant standard.[32] Challenges such as these will constitute a major, and critical, focal point of debate over the clean air program in this phase of criteria document revision for a half-dozen years to come and perhaps perennially thereafter.

Implementation of the Act

Action to implement the standards has provided equally intense debate. In concept the implementation or control system anticipated by the 1970 Act was quite simple. First, there was the ambient air standard,[33] a bench mark which established outer limits of air contamination. Behind this was a source that emitted pollutants which had to be controlled in order to improve air quality. Some system had to be devised to relate emissions from the source to the level of ambient air quality. That system turned out to be a process of mathematical modeling which served as a predicting device. Given a pattern of sources, with given levels of emissions, located in given terrain and amid given wind speeds and direction, the ambient air quality would be predictable. One could work backwards from ambient air quality to allowable emissions at the source.

Needless to say, this was very complex and provided opportunities for considerable choice, personal judgment and error in establishing an effective causal relationship. Because of this extensive "grey area" for choice, in the 1970 Act some environmentalists had preferred a direct emission limitation with prescribed technological controls rather than the cumbersome attempt to relate emissions to ambient levels; but their views were rejected.[34] The initial calculations were based on limited knowledge of source emissions. As control plans evolved in the mid and late 1970's, more elaborate data were developed. Many calculations distinguished between "point

32. 7 Envir. Rep.—Current Dev. (BNA) 1191 (Dec. 17, 1976), 1919 (Apr. 15, 1977), 1972 (Apr. 22, 1977); 8 Envir. Rep.—Current Dev. (BNA) 11 (May 6, 1977).

33. 42 U.S.C.A. § 7409 (Supp. 1977).

34. *See* Esposito, *supra* note 2, at 259.

sources"—the larger emissions sources, and "area sources"—the small and the more generalized such as wind-blown dust.[35] Even after agreeing upon this data, much choice remained. For example, what model should be utilized to establish the relationships? There were a number of options, often varying with the weights given to various factors such as unmeasurable sources, wind direction, and terrain. Even if all could agree about the model itself, there was the question of changes in the emission sources which might occur after the initial inventory, including increases and decreases in the number of sources and in the kind and mix of fuels used which generated varying emission levels.

Options also arose concerning the location in which ambient air was to be measured. Traditionally such measurements were taken in the vicinity of the source. In the Bay Area Pollution Control District in California, for example, the relevant monitor was located at the property line of the source at ground level; no more distant measurements applied. In such circumstances sources were tempted to develop techniques to diffuse pollution into the wider atmosphere and to reduce its local impact, such as with a tall smokestack which carried the air upward into the atmosphere, as much as 1000 feet, to "disperse" it. "Dispersion enhancement" techniques were adopted by electric utilities as a preferred "control system." This led to vast discrepancies between the ambient standard and the emission. In the case of the Bay Area Pollution Control District, the Exxon oil refinery at Benecia emitted sulfur dioxide at a rate of 6000 ppm (24 hour average) when measurements at the property line at ground level were 0.04 ppm; this placed the source in compliance. The actual emissions were dispersed into the San Joaquin Valley to the east, contributing two-thirds of the total sulfur dioxide load there.[36]

Such practical difficulties as these, encountered in establishing a firm control system for relating emissions to ambient air, with persistent opportunities for escaping control, increased the popularity of a direct, technological standard which would prescribe the precise technology to be required. This development was shaped heavily by

35. For a calculation of sulfur dioxide levels for eight urban air-quality maintenance areas in Pennsylvania, with an emphasis on both point sources and area sources, see *A Study of Existing and Projected Sulfur Dioxide Levels in Pennsylvania—8 AQMA's* ENGINEERING-SCI. (1977).

36. California Air Resources Bd., 9 Bull. 1, 5 (Jan. 1978).

the debate over intermittent controls for power plants, involving the use of tall stacks. The EPA argued that the law permitted it to require new technologies, such as flue gas scrubbers, to remove sulfur oxides, while the industry maintained that the law permitted dispersion by means of tall stacks. Court decisions persistently favored the EPA interpretation,[37] and in the 1977 amendments the language was changed to prevent ambiguity. It required all new sources to establish the "best technological system of continuous emission reduction," thereby defining control systems in terms of technology rather than of "meeting the standard."[38]

The gradual specification of controls in terms of technology was much akin to the same tendency which had occurred in water pollution control. Over a decade of experience emphasizing ambient water quality had brought out the vast difficulties in relating specific water discharges to general water quality. Consequently, the Clean Water Act of 1972 had specified technological standards: the first stage was described as the "best practicable technology" and the second as the "best available technology." Such an approach in air quality gave rise to a number of terms, such as "best available control technology," or "lowest achievable emission rate," each of which represented an attempt to spell out technological controls more precisely. The precision was not always achieved, as one set of terms became confused with another; but the general drift toward technology standards as the most effective means of source controls persisted.

To be effective, the conceptual control system just described had to be translated into an administrative control system. Some administrative strategies had to be devised in order to establish a regulatory process. In the first instance, this had two elements. First, each state had to develop a "state implementation plan" (SIP) which established the administrative rationale by which the federal standards, or more stringent state standards, would be achieved. The federal EPA would approve or disapprove the SIP on the grounds of whether or not it would enable the standards to be met. The specific control system involved a mixture of orders, reviews and permits, varying with each state. Usually a variance system was established whereby a source could secure permission not

37. Kennecott Copper Corp. v. Train, 526 F.2d 1149 (9th Cir. 1975); Big Rivers Elec. Corp. v. EPA, 523 F.2d 16 (6th Cir. 1975); NRDC v. EPA, 489 F.2d 390 (5th Cir. 1974).

38. *See* 1977 U.S. CODE CONG. & AD. NEWS 1261-62.

to meet the emission level in the prescribed time in exchange for an agreement to meet a given set of conditions in a more extended timetable.

Such a regulatory scheme set in motion a vast amount of legal action which brought enforcement squarely into the courts. If a polluter did not comply with the conditions of the permit, or with the terms of a variance, enforcement action could be brought. Often the initial stage of enforcement action led to an impasse in the courts; polluters argued that the needed technology was not "available" while the agencies argued that it was. Left in the middle of such controversies, courts frequently supervised an agreement between the contending parties which emerged in the form of a consent decree or a court order. Such action, however, did not guarantee compliance. Often, especially in the case of industries in which cleanup was more difficult, it only set off another round of lack of compliance, enforcement action and litigation.

By the mid-1970's many from the enforcement agencies and the active environmental public began to argue that the courts were used merely to stall pollution abatement, that litigation was, in fact, less expensive than the cost of implementing controls and that some device should be developed in order to make the regulatory process more direct and effective. Economists had long argued that the major focus of regulation should be a tax, such as an emissions fee, to internalize the social costs of pollution.[39] Such a proposal was made by President Nixon at one point and was quickly withdrawn. An economic penalty of a different sort, the noncompliance penalty, was incorporated into the 1977 amendments. The theory behind it was that if polluters did not clean up by the specified compliance date, they would be permitted to continue, without legal action taken against them, but with a fine, imposed daily, equal to the cost advantage for not complying. This, it was argued, would substitute a direct economic penalty for lengthy litigation; but such arguments did not clarify how the details of such a fee, its specific level and rationale, could themselves escape prolonged court action.[40]

Despite all these mechanisms for implementation of the desired

39. A major center for the dissemination of such a view was Resources for the Future. *See, e.g.*, CURRENT ISSUES IN U.S. ENVIRONMENTAL POLICY (1978).

40. *See* 1977 U.S. CODE CONG. & AD. NEWS 1150-51. Support for an emissions charge was expressed by a variety of sources such as the national Academy of Sciences-National Academy of Engineering and the Committee for Economic Development. *Id.*

levels of air quality, the primary focus of the program was to stimulate a more socially desirable technology. Existing technology had social impacts which were considered to be socially undesirable. Shifts to more acceptable technologies did not seem to come through private market action alone; therefore, some sort of public action was deemed essential. In the midst of the details of enforcement, participants often lost sight of the fact that the major thrust of the 1970 Act was "technology forcing."[41] It was easy to argue that technology was "available" or that it was not, and to focus on some stage of technological development as the critical point in whether or not it was. The legal questions surrounding such debates often obscured the most important point: how can public action be taken to stimulate the development of technology which was not yet in place?

The public sector has available a considerable number of options to achieve that objective. Such techniques have been used for decades, even centuries; and they should be brought alongside each other for comparative analysis, in order to focus on the major technological thrust of the Clean Air Act. The nuclear power industry, for example, was promoted by direct public investment; it would be equally possible for the federal government to build and operate a prototype coke oven or electric utility for the precise purpose of developing and demonstrating new technologies. The role of the Tennessee Valley Authority innovation in electrical transmission to rural areas is a classic case. Many environmentalists wondered why the TVA, as a publicily-owned utility, could not play a similar role in creating a cleaner coal-burning technology. By the time of the Carter administration and the appointment of S. David Freeman to the TVA Board, it appeared that such an opportunity was at hand.

The major means utilized by the Clean Air Act of 1970 to stimulate new technology was the guaranteed market. Firm compliance dates for installation of pollution-control equipment—flue gas scrubbers, for example, established a firm market for potential manufacture of that technology. With such a guarantee, capital risks would be undertaken by enterprising engineering firms. The economic incentive in such an arrangement lay not with either the regulator or the regulated, but with the third party, the manufactur-

41. *See* J. E. Bonine, *The Evolution of "Technology-Forcing" in the Clean Air Act*, ENVIR. REP.—Monograph 21 (July 25, 1975).

ers of the control equipment. The success of the technology-forcing mechanism of the guaranteed market would lie in the degree to which it stimulated innovation. If one followed the course of the history of member firms of the Industrial Gas Cleaning Institute, which represented industrial air-cleaning industries, one could readily conclude that the market-stimulating mechanisms of the Act had worked.[42] EPA developed close relationships with such firms in order actively to stimulate the new technologies.

Technological innovation depended upon the commitment of installing firms to meet compliance schedules and to work cooperatively with equipment manufacturers to perfect it. Some did and some did not. Some utilities, for example, established unusual contractual terms for the purchase of equipment, requiring guarantees for unusually long trouble-free performance, and relatively high levels of consequential damages.[43] Installation of flue-gas scrubbers by utilities often depended upon their willingness to employ chemical engineers who could deal with the attendant chemical problems in an industry long dominated by other technical expertise. Once commitments had been made to investment in one form of environmental control technique, considerable additional incentive arose for alternative suppliers to develop new techniques to lower the cost. The initial step of willingness to comply developed quickly into an even more powerful incentive—cost reduction—once commitment to control had been made. Problems such as these emphasized the degree to which a direct approach to technological innovation became more important as the air-quality program evolved.

The focus on new technology took on even sharper emphasis as the timetable for urban cleanup was not met and the question arose regarding whether or not new sources would be allowed in such areas which had not yet attained the primary air quality standards. By 1976 this was known as the "nonattainment" problem, and considerable debate ensued over the options. The issue was forced by the application for permits from new large sources in several cities such as Pittsburgh, Houston, and Los Angeles. In each case, failure of old sources to clean up made it difficult to justify the creation of new

42. S. Miller, *The Business of Air Pollution Control*, 7 ENVT'L. SCI. & TECH. 988 (1973).

43. *See* R. E. Ayers, *Enforcement of Air Pollution Controls on Stationary Sources under the Clean Air Amendments of 1970*, 4 ECOLOGY L.Q. 445, n.11 (1975) (quoting from EPA, Report of the Hearing Panel, National Public Hearings on Power Plant Compliance with Sulfur Oxide Air Pollution Regulations, Jan. 1974).

sources which would create backsliding in air quality by raising allowable pollution levels. Lack of attainment of desired emission levels by old sources restricted the growth of new industry. This implication of the Clean Air Act of 1970 was sharpened as the federal EPA devised a policy both to permit such new sources and, at the same time, to guarantee progress toward meeting the standards. By 1977 the nonattainment problem became one of the major elements of debate over amendments to the Act. It placed sharp focus on the need for technological innovation from both old and new sources if economic growth in "dirty air areas" was to proceed.

INNOVATIONS

Although the Clean Air Act amendments of 1977 covered a wide range of subjects, it is generally recognized that three constituted the most extensive innovations from the 1970 Act: provisions for prevention of significant deterioration, non-attainment, and delayed compliance penalties.[44] Since the evolving circumstances which gave rise to these provisions have been discussed above, we will turn to their implications.

While in 1970 the prevention of significant deterioration occupied a peripheral role in the Act, by 1977 it had come to play a central part; this was one of the more dramatic changes in the context of air-quality politics. During the 1960's federal officials responsible for the air-quality program had committed themselves publicly to a "nondegradation" policy. Such commitments had been repeated in legislative committee reports during debate on the 1970 law; however, few members of the public or of active environmental organizations had taken up the issue. In pressing the nondegradation implications of the 1970 Act, and in carrying on the ensuing debate which arose from this, the Sierra Club generated an active constituency that was much larger than before. Although some concern for protecting clean air areas had existed previously, it certainly had remained latent and was not activated until the issue was pressed. By 1977 a significant political base for a "prevention of significant deterioration" policy had developed.

As the issue evolved from a set of EPA regulations to explicit legislation, the latter moved beyond even the former. EPA regula-

44. For the relevant sections of the statute, see 42 U.S.C.A. §§ 7470-7491, 7501-7508, 7420(d) (Supp. 1977).

tions had established a series of air quality classes—I, II and III. Each would have permitted some deterioration of air quality—Class I permitting the least and Class III the most—up to the level of secondary standards. Eventually, therefore, there would have been two levels of air quality standards in addition to the primary and secondary levels already in existence.[45] EPA regulations, moreover, established machinery in which all areas of the nation outside the "nonattainment" areas would automatically be designated Class II; each state had to set in motion machinery whereby, after extensive procedural requirements, Class II areas could be redesignated either Class I or Class III.

In three important respects environmentalists considered this scheme to be flawed. First, no areas were declared to be mandatory Class I areas, a limitation which, in the absence of state action, could have excluded any area from being subject to the least amount of deterioration. Second, Class III areas could deteriorate to the level of secondary standards when, it was contended, they should be required to fall short of that level, thus establishing a five-tiered system instead of the EPA four-level plan. Third, the EPA regulations applied only to particulates and sulfur dioxide, not to the remaining four criteria pollutants.[46] The ensuing debate in Congress resulted in approval of all three of these principles, thus reflecting the enhanced degree of interest in PSD beyond the EPA action as well as the 1970 Act.[47]

Closely connected with the legislatively mandated PSD program was the equally innovative explicit protection of visibility in certain park and wilderness areas. The amendments provided that the Secretary of the Interior designate the precise areas where visibility was an important value and that states incorporate those designations into their implementation plans.[48] As discussed above, visibility had been among the "welfare effects" covered by the secondary standards, but had received little subsequent attention. Concern increased, however, about visibility in the scenic areas of the west, with special attention to the impact of coal-burning electric generating plants on both the Grand Canyon and the parks of southern

45. *See* 40 C.F.R. § 51.21 (1977).

46. *See* 1977 U.S. CODE CONG. & AD. NEWS 1181-82.

47. *See* B. I. Raffle, *The New Clean Air Act—Getting Clean and Staying Clean,* ENVIR. REP.—Monograph 47 (May 19, 1978).

48. *Id.* at 17.

Utah. The National Park Service had taken up the issue of the resulting destruction of scenic resources, and the drive for explicit protection in the 1977 amendments was successful.[49]

One important aspect of the PSD provisions was to limit an escape hatch which had permitted polluting sources to move from more polluted to cleaner air areas. Heretofore there were few restrictions on such a move; air quality professionals had previously stated that such action was desirable in order to enable polluting facilities to move beyond the urban areas.[50] The PSD provisions now placed restrictions on this option. Especially significant was the procedure adopted by EPA that implementation would require new sources, even in nonattainment areas, to undergo review for their potential impact on adjacent cleaner air areas.[51] The long-distance transmission of air pollution made it impossible to consider such sources in isolation, within their own air quality region, and required impact analyses on cleaner air areas at some distance. This type of analysis was destined to bring a new perspective to air quality measurement, control and evaluation throughout many areas not hitherto subject to intensive air quality management.

The nonattainment provisions of the 1977 amendments had equally significant implications. Most important was their implication that one had to think in terms of total pollution loads and not just percentage reductions from given historic levels. Previously it had been customary to think in terms of reductions from 1970 base lines. There was general recognition that such reductions could be more than offset by increases in the number of polluting sources and that, at some future date, the more severe problem of constraints in terms of total loads would have to be confronted. Initially, however, this was postponed. During the early years of implementation of the 1970 Act, successful litigation by environmentalists resulted in the requirement that EPA plan not only for reaching air quality levels but also for maintaining them in the face of economic growth.[52] The program was implemented by a number of less urban-

49. *See* note 13 *supra*.

50. *See* M. W. First, *Process and System Control* in AIR POLLUTION 316 (A. C. Stern ed. 1968).

51. 8 ENVIR. REP.—Current Dev. (BNA) 1109 (Nov. 25, 1977); *see also* 40 C.F.R. § 52.21(d) (1977).

52. *See* NRDC v. EPA, 475 F.2d 968 (D.C. Cir. 1973). *See* 38 Fed. Reg. 6279, 9599, 15,834 (1973); 39 Fed. Reg. 16,343, 25,330, 28,906 (1974); 40 Fed. Reg. 18,726, 23,746 (1975) for the regulations.

ized governmental units facing potential air deterioration from future growth, but it was generally ignored in the larger cities where standards had not yet been reached and there were no primary levels yet to maintain.

In these areas the issue of the impact of new sources was faced by proposals for new industries amid nonattainment of the primary standards. As the issue became more sharply etched, it defined the air quality problem as one of finite air resources pressed by increasing quantities of pollution associated with economic growth. This classic definition of ecological problems became clearer as the clean air program evolved and especially as the nonattainment problem became prominent.

The critical role of technological innovation in such nonattainment areas also became more sharply etched. If growth were to be permitted, the level of cleanup from each source would have to be greater than heretofore envisaged. Earlier the "best" technology had been thought of as the "best available control technology" or BACT; now the nonattainment policy defined "best" as the "lowest achievable emission rate." The latter brought a wider range of comparisons into focus, enabling the administering agency to draw upon technological examples from anywhere in the world to demonstrate what was achievable. The model to be followed was not just what could be "demonstrated" but what could be "achieved." Such a test was not above controversy, but it constituted greater pressure for technological improvement in order to forestall the need to limit growth in the face of heavy pollution loads pressing against finite air resources.

The nonattainment policy provided some innovative mechanisms which could have rather extensive ramifications. A new source would be permitted in a nonattainment area if the total combined pollution from that and old sources were reduced over previous levels. Such allowable action envisaged the practice of new sources, which would increase pollution, working out "trade-offs" with old sources to reduce pollution even more, thereby permitting the new source to be constructed. Actions taken to reach the requirements of the state implementation plan would not be allowed as part of the "credit" in such a trade-off, but reductions beyond that point would. Hence, incentive would be built into the construction of new sources which would encourage those who wanted to build new plants to take private action to reduce pollution levels. One could well envisage the purchase and sale of pollution "credits" and perhaps even the process of "banking" them to be used in the future.

This trade-off policy placed the entire burden of facilitating new growth in a nonattainment area on those promoting that growth when, in fact, the responsibility for restricting growth lay in the failure of old sources to clean up. Should not the burden of action fall on the old rather than the new source? Debate over this issue during action on the 1977 amendments led to another approach which would place more burden for creating allowable air quality increments on old sources. It emphasized revision of the state implementation plans to provide for a "growth factor." Merely to meet the standards, maximum air contamination levels would have to be modified to include a margin for new growth in addition to the standards. Responsibility for creating this cushion would fall on old sources for whom cleanup would now have to be greater in order to accommodate new growth.[53] The approach was very similar to the "growth factor" required in allocating water pollution waste loads on water quality limited streams.

The delayed compliance penalty, the third of the major innovations of the 1977 amendments, arose out of the general concern for program effectiveness. How could a regulatory scheme produce better results more rapidly? The focus on results generated a variety of opinions as to what the problem was and what innovations should be made. To many environmentalists and regulators, the main problem was the way in which litigation provided an opportunity to stall because it was cheaper than compliance. Their aim was to reverse the advantage and to make litigation more costly than compliance. To economists, the problem was one of general rules applied to varied circumstances, resulting in wide variations in the costs incurred by polluters as compared with the benefits. To them, the source should first be confronted with a cost, such as a fee for the "right" to pollute, and then be free to determine what action should be taken to clean up in order to avoid the cost. To legislators and regulators, one of the most severe problems in implementation was equity. How to develop a program which would apply fairly and equitably to all and would avoid the claim, with resulting litigation, that one community or state, or one firm in an industrial category, had an advantage over another. Finally, if one emphasized the

53. *See Clean Air Act Amendments of 1977,* Steelworkers Legislative Newsletter, Sept. 12, 1977, at 3-4 (attachment).

larger problem of forcing a more desirable technology, then direct technology requirements made sense irrespective of issues of litigation escape hatches, variable cost-benefit ratios, or equity in application. When the private market seemed too slow in generating and diffusing desirable technology, did it not make sense to establish public technology forcing programs across the board?

The 1977 amendments dealt with this problem in only a limited way; in fact, debate over the amendments did not focus sharply on these issues. For the most part, they emphasized the immediate litigation problems of enforcement: how to end the interminable round of agreements, failure to meet agreements, litigation, consent orders, and further stalling, all apparently because such action was less expensive than compliance? The answer was the noncompliance penalty which permitted sources to go beyond the prescribed compliance data by paying a penalty equivalent to the economic advantage of noncompliance. This, it was hoped, would prod the more recalcitrant sources into action. For the most part, this scheme would give regulators more leverage in negotiating with polluters to persuade them to install less polluting technology without delay. By this scheme existing enforcement could produce the prescribed results more rapidly.

The focus on enforcement often obscured the major goal of technological innovation. The fundamental controversy over air quality was one of developing new technologies. Private industry had failed to bring about more socially desirable methods of production, thus giving rise to public action to stimulate change. The most dramatic expression of this concern lay in the continual emphasis, even though relatively obscured from public view, on the development of a pollution-free automobile, and the constant exasperation on all sides about the slow pace with which private industry moved in this direction. Public funding was provided for some innovations, but it often appeared that efforts toward more pollution-free technologies moved far too slowly. The air quality program did drive change somewhat in this direction, such as fluid bed combustion which could make possible a much cleaner method of burning coal. Even more important was the hope that on-site solar energy systems, and especially design of passive systems, solar collectors and photovoltaic cells would generate a more "benign" process of energy conversion and application.

While the 1977 amendments addressed themselves to more effective enforcement through the noncompliance penalty, they did not focus more precisely on the problem of technological innovation. In this all-important aspect of air quality, one could detect only a limited evolution of focused thought between the 1970 and 1977 acts.

DEVELOPMENTAL PERSPECTIVES

Thus far we have emphasized the legislative and administrative evolution of the Clean Air acts. Underlying these more formal aspects of change, however, lay some significant developments in perspective. Some of these arose from the realities encountered in implementation, but others came from scientific inquiries which took place in the 1970's. What was known in 1977 about air pollution, its creation, movement and effects, was vastly greater than what was known in 1970. The impact of this new knowledge was more a matter of redefinition of the problem than acquisition of firm answers. One could well argue that by 1977 the conception of air pollution as a problem had changed markedly since 1970 and that such a change in perception had a profound influence on the course of the politics of air quality. New realities and new perceptions of problems exercised, in a subtle way, a controlling influence on the evolution of programs and policies.

First was the emergence of cancer to take a more central role in the health effects problem.[54] Most of the discussion about air pollution in the 1960's, which provided the background of perspective in which the 1970 Act was formulated, concerned the acute effects of high-level episodes. "Disasters" were cited such as those in Donora, London and in the Meuse Valley in France. The health effects of these episodes usually emphasized deaths due to pulmonary or cardiovascular diseases, or the worsening of such problems in susceptible populations. It was not surprising that one of the major groups to become involved in the drive for clean air was the American Lung Association. It was around such problems that much of the meaning of the term "environmental health" developed.

By the mid-1970's, however, the environmental causes of cancer began to define the health effects of air pollution. It became ac-

54. *See* 1977 U.S. CODE CONG. & AD. NEWS 1183-84. For current knowledge of low-level pollutants, see H. R. SUBCOMMITTEE ON THE ENVIRONMENT AND THE ATMOSPHERE, COMM. ON SCIENCE AND TECHNOLOGY, THE COSTS AND EFFECTS OF CHRONIC EXPOSURE TO LOW-LEVEL POLLUTANTS IN THE ENVIRONMENT (1975).

cepted that 60%-90% of all cancers were environmentally caused. The term "environment" in this case covered a wide range of circumstances, of which the most important was smoking, and probably 15% consisted of ambient air pollutants. The emphasis provided a new focus for air pollution concerns. The "criteria" pollutants, as well as additional hazardous airborne materials, might contribute significantly to the growing incidence of cancer. One aspect involved the components of particulates which heretofore had been subjected to gross measurement. Analysis of particulates emphasized the importance of sulfates and nitrates as derivative pollutants. It also stressed the much larger number of additional harmful chemicals inherent in fossil fuel combustion, such as coal tars in general, benzo-a-pyrene and trace metals. When isolated in experimental situations, these could be identified as having distinctive adverse health effects.

Environmental cancer effects first became prominent in the regulation of pesticides. The DDT issue, in the initial administrative proceedings in Wisconsin, emphasized adverse effects on bird reproduction.[55] As pesticide regulation evolved, however, the potential cancer effects on humans moved into the spotlight. A new emphasis on similar effects of chemicals in the workplace also emerged by the mid-1970's to generalize the cancer problem still further. Epidemiological work by Dr. Irving Selikoff in asbestos exposure played an especially important role in extending this perspective. By 1977 the Occupational Health and Safety Administration had evolved a generic policy on carcinogens through which it hoped to deal with a broad range of potential carcinogenic substances in the workplace.[56] Late in 1977 the Environmental Defense Fund petitioned the EPA to apply the same approach to hazardous air pollutants. Although the Act of 1970 had contemplated action on this front, the EPA sought to regulate few such ambient air pollutants.[57] The EDF petition brought cancer effects back to a significant role in air pollution policy.

55. *See* Thomas R. Dunlap, Publicity, Environmental Law, and DDT (paper presented at the meeting of the Organization of American Historians in Atlanta, Ga. (Apr. 7, 1977)).

56. 42 Fed. Reg. 54,148 (1977).

57. Environmental Defense Fund, Petition for the Initiation of Rulemaking Proceedings to Establish a Policy Governing the Classification and Regulation of Carcinogenic Air Pollutants Under the Clean Air Act (Nov. 4, 1977). *See also* EDF, Testimony of the Environmental Defense Fund at a Public Meeting to Solicit Recommendations Useful in Developing a Comprehensive Program for the Regulation of Carcinogenic Air Pollutants (Mar. 23, 1978).

An equally important new perspective began to emerge as the combined effects of two or more pollutants—their "synergistic effects" were investigated.[58] The 1970 Act program envisaged separate controls for six separate criteria pollutants;[59] but as new knowledge accumulated, it became clear that this did not accurately reflect the way in which effects occurred. The combined impact of two pollutants acting together was often greater than either one singly. Adverse effects of one in conjunction with another could be observed at levels lower than with the one by itself. Such synergistic effects could be observed most clearly in laboratory situations where exposures to plants and animals could be controlled. They were more difficult to determine in the case of human life not subject to experiments. Yet it was generally accepted that air pollution involved exposure to many substances in combination. This recognition led some to hope that epidemiological studies could be advanced to measure the total impact of exposure to varied human populations.[60]

If one were inclined to accept the importance of "welfare effects" on crop production or the validity of experimentation on laboratory animals as a basis for drawing conclusions about human life, then the experimental data would become increasingly impressive. Ozone was found to enhance the effects of sulfur dioxide in crops and food plants; some triple combinations, such as ozone, sulfur dioxide and particulates, were found to be operative. It was difficult to know how to specify such effects precisely, yet increasing knowledge about them convinced many that the effects analysis of the initial criteria documents might not be sufficiently stringent rather than the reverse. In California it gave rise to standards more stringent than the federal.[61] Knowledge about synergistic relationships would profoundly affect the way in which air pollution impacts were viewed and, even in the absence of precise information, would tend to make judgments about allowable levels more conservative.

Even more profound was the increasing knowledge about long distance transmission of pollutants and their transformation into chemical forms that might be even more harmful.[62] Scientific data

58. *See* 1977 U.S. Code Cong. & Ad. News 1197-98.

59. *See* note 7 *supra*.

60. *See* the introductory remarks in EPA, Health Consequences of Sulfur Oxides: A Report from CHESS, 1970-1971, No. 650/1-74-004 (May 1974).

61. *See* California Study, Staff Report, Vegetarian Effects 49 (Mar. 15, 1977).

62. *See* EPA, Position Paper on Regulation of Atmospheric Sulfates, No. 450/2-75-007

emphasized the creation of derivatives of the criteria pollutants in the atmosphere. This included transformation of sulfur dioxide and nitrogen oxide into sulfates, sulfuric acid, nitrates, nitrites and nitric acid, and a range of results, especially ozone, derived from photochemical reaction with hydrocarbons and nitrogen oxides. These brought into focus new types of health effects. Sulfur dioxide, for example, was recognized as harmful to human life not in itself, but from its transformation into sulfates and sulfuric acid mists. Similar effects occur with nitrogen compounds. The first of these to receive explicit attention was sulfates. By the end of 1977 California had adopted a sulfate standard and the EPA, prodded by environmentalist litigation, had such action under consideration.[63]

The problem of transformation generated a new, regional, dimension to the definition of air pollution as a problem. Chemical derivatives, which formed during transmission in the air, produced effects at great distances from the sources where their parent precursors were generated. Whereas formerly air pollution was viewed as a local problem, with primary emphasis on local fallout, new knowledge began to define it as a regional problem, often cutting far across state lines and requiring coordinated regional control. Data on the creation of ozone as wind currents moved from New York City northeast across New England gave rise to a demand from Massachusetts that some control be exercised on the source of the problem in New York. By early 1978, litigation on this issue to force New York City to control its oxidant precursors had been initiated. An increasing amount of data defined the movement of wind currents from coal combustion sources in the Midwest, such as Illinois, Ohio and Indiana, to the Middle Atlantic States and New England.[64] Resulting acid precipitation had significant adverse impacts on aquatic life in areas such as the Adirondacks. The phenomenon

(Sept. 1975); HOUSE SUBCOMMITTEE ON THE ENVIRONMENT AND THE ATMOSPHERE, COMMITTEE ON SCIENCE AND TECHNOLOGY, RESEARCH AND DEVELOPMENT RELATED TO SULFATES IN THE ATMOSPHERE (1975); A. P. Altshuler, *Regional Transport and Transformation of Sulfur Dioxide to Sulfates in the U. S.*, 26 J. OF THE AIR POLLUTION CONT. A. 318 (1976).

63. *See* California Air Resources Board, Research Division, Review of the 24-Hour Sulfate Ambient Air Quality Standard, Staff Report No. 77-20-3 (Sept. 29, 1977).

64. *See* EPA, Office of Research and Development, Research Highlights, 1977, No. 600/9-77-044 (Dec. 1977); L. F. Smith and B. L. Niemann, The Ohio River Basin Energy Study: The Future of Air Resources and Other Factors Affecting Energy Development (paper presented at the Third International Conference on Environmental Problems of the Extractive Industries in Dayton, Ohio (Nov. 29-Dec. 1, 1977)).

of "acid rain" created a new problem perspective in air pollution matters.[65]

These new perspectives—the definition of health effects in chronic, rather than acute, terms with emphasis on long-term accumulated impacts and especially cancer; the observation of the greater effects from synergistic reactions; and the long-distance transmission and transformation of pollution—had their complex and their simple elements. One could argue that such new knowledge added complexity and confusion to an already confused situation and that little sound knowledge for action was available. Cutting through these details, however, were perspectives which defined a set of problems, each relatively simple in conception, which exercised considerable power in how air quality problems were approached. Caution increased in allowing a higher level of pollution as did a willingness to argue that standards might not be stringent enough. Also, there arose a strong sense of the need to control pollution at the source rather than to permit it to disperse, thereby incurring the risks which expanding knowledge seemed to emphasize.[66]

These new perspectives gave rise gradually to a growing conception of clean air as a source and limited resource. In 1970 clean air had been thought of as a goal to be achieved. Pollution was the problem, and a program was devised to reduce it. During the decade, however, a gradual shift in awareness took place: clean air was viewed as something both valuable and finite. The constant pressures of pollution, in spite of efforts to clean up, gave rise to a more protective stance, one which focused more on the air as a resource to be defended against persistent intrusion. The fund of clean air could not be expanded alongside the expansive potential of pollution. As that fact became more deeply etched into human consciousness, clean air as a finite resouce became the starting point in problem definition.

Thus, urban areas realized that if limited available clean air were used for one purpose, it could not be used for another. If one source polluted air, this preempted the available air and prevented use by

---

65. *See* U. S. DEPT. OF AGRICULTURE, FOREST SERVICE, PROCEEDINGS OF THE FIRST INTERNATIONAL SYMPOSIUM ON ACID PRECIPITATION AND THE FOREST ECOSYSTEM (General Technical Report NE-23 (1976)). For international Canadian-United States implications of acid precipitation in North America, see R. LeBlanc, *Long Range Transport of Air Pollutants,* 27 J. OF THE AIR POLLUTION CONT. A. 828 (1977).

66. *See* note 10 *supra.*

another. The finiteness of clean air itself constituted a limit on new economic growth which depended on limited allowable levels of pollution. As pollution spread across the nation, even into nonurban areas, a growing sense of the limited number of cleaner air areas in the nation arose. Measurements by the mid-70's indicated that while sulfur dioxide levels had been reduced in the cities, they had remained more stable in areas beyond. Moreover, in the nonurban areas, sulfate levels remained high. Ozone, the most ubiquitous pollutant of all, pervaded the entire eastern part of the nation which was declared, in its entirety, a nonattainment area for that pollutant. Such facts as these added incremental weight to the implicit definition of air quality problems as the protection of a finite resource against invasion by pollution.

STRUGGLES IN THE EVOLUTION OF THE AMENDMENTS

The most surprising aspect of the debate over the 1977 amendments was the strength of the environmental side of the controversy. Witnesses to three years of intense struggle over the amendments frequently attested to the heavy political resources brought to bear by various economic groups to weaken the 1970 law. Yet at each stage of the legislative process, firm counterforces were at work to protect, and even strengthen, the Act. When it finally emerged from the tortuous process, few serious inroads had been made in it; and in some respects it had become stronger. In spite of the persistent claims that environmental strength was at an ebb and had declined since the 1970 Act, such was not the case. Although we cannot hope to identify and explain this strength fully, it calls for some analysis within the evolving political context.

As the drive for national air quality standards accelerated in the late 1960's, industrial opposition to them, spearheaded by such groups as the American Mining Congress, the National Coal Association, the American Petroleum Institute and the American Iron and Steel Institute did so as well.[67] The 1970 Act was changed considerably in the final stages of legislation in the direction of a stronger national program; this caught industrial opposition somewhat by surprise. This, in turn, generated a major counterattack during 1971 as three rule-making processes under the Act took

67. *See* Vietor, note 2 *supra,* at 292.

place: ambient air quality standards, guidelines for states under which they were to draw up implementation plans, and new source performance standards. Input into these rulemaking processes by industry was heavy. Industry took an especially strong stand on the implementation guidelines and utilized successfully its informal relationships with the Department of Commerce, the Federal Power Commission and the Office of Management and Budget in order to thwart stronger federal leadership. It was especially successful in weakening severely the guidelines to the states, one of which pertained to an anti-degradation program. Environmentalists were able to defend both the ambient, and the new source performance standards more effectively.

A major instrument of industrial influence in these early years of the Act was the National Industrial Pollution Control Council, established by President Nixon and composed of representatives of corporate firms and housed in the U.S. Department of Commerce.[68] While the Council (NIPCC) ostensibly served to provide useful information to the administration, in doing so it constituted a strategic political influence on policy. Often it and the Department of Commerce, through which it spoke, were instruments of action at the Office of Management and Budget and in interagency deliberations. Meetings of the Council were closed to the public, but its work was financed by public funds. These two factors proved to be its undoing. Environmental criticism of its work focused on the facts of secrecy and finance. Finally, Representative John Dingell of Michigan took the lead in a successful move to cut off funding and eliminate it as a focal point of influence.

The attack on the 1970 Act from the industrial community continued at a persistent pace. It sought to influence public opinion by emphasizing such themes as "overregulation" or "overkill," as the term was widely used for a few years, and the loss of jobs, an argument which came to be prominent as industry sought active support from labor. When it became clear that environmental regulations led to the loss of few jobs and in fact created more than it eliminated, the arguments shifted to capital costs and inflation. In a considerable number of court cases, industry took up a legal attack on the Act which persisted throughout the decade, but with only

68. For accounts of the NIPCC, see G. J. C. Smith, Our Ecological Crisis 167-72 (1974); Vietor, *supra* note 2, at 292-344.

mixed results; up through the 1977 amendments the courts had upheld the major elements of the 1970 law. The effort to discredit the scientific basis for air quality regulations, begun in the late 1960's, continued through such actions as the attempt to undermine the credibility of reports from the National Academy of Sciences[69] and the widely debated CHESS report drawn up by EPA.[70] Utilities and the coal industry focused especially on the sulfur dioxide standard and the analysis of its health effects; they were increasingly concerned with the new role of sulfates and long distance transmission on regulatory programs.

Despite these attacks, the environmental side, though greatly outweighed in financial and technical resources, was able to organize sufficient strength to mobilize latent public support effectively in the political debate. One crucial organization in this was the Natural Resources Defense Council which emphasized litigation and brought many of the environmental clean air cases.[71] These were carefully selected to affect general problems of rulemaking and administrative policy. The NRDC was the front line of environmental defense of the air quality program. Especially valuable to environmentalists was the expertise which evolved within NRDC with respect to the complexities of administrative action and the scientific and technical aspects of air quality. By drawing experts into the orbit of litigation, the environmental movement was able to exercise significant leverage. By mobilizing such skills, litigation organizations became centers of political strength which EPA and other participants in air quality politics had to take into account in

69. See 5 ENVIR. REP.—Current Dev. (BNA) 1873 (Mar. 28, 1975) for an account of the NAS report. To counteract the effects of this report, the Federal Energy Administration contracted with Tabershaw/Cooper Associates, Rockville, Maryland, to do a similar evaluation, a draft of which was released almost simultaneously with the NAS report and was entitled A Critical Evaluation of Current Research Regarding Health Criteria for Sulfur Oxides. According to Frank Zarb, administrator of the FEA, the initial discussions on the contract began in Nov. 1974; it was signed Feb. 5, 1975; the draft was completed Feb. 15, 1975. In discussions on the FEA report before the Senate Public Works Committee, Senator Randolph suggested that it could be called a "tailored report." Zarb argued that both the NAS and the Tabershaw/Cooper reports should be given "equal weight" in assessing health effects. *See* 5 ENVIR. REP.—Current Dev. (BNA) 1871 (Mar. 28, 1975).

70. *See* 5 ENVIR. REP.—Current Dev. (BNA) 1888 (Mar. 28, 1975), 2125 (Apr. 16, 1976); 7 ENVIR. REP.—Current Dev. (BNA) 32 (May 14, 1976), 285 (June 18, 1976), 496 (July 23, 1976).

71. *See generally* NRDC's Report; for NRDC input into the early 1971 proceedings, see Letter from Richard E. Ayres to William D. Ruckelshaus, March 15, 1971, enclosing Comments on the Proposed National Primary and Secondary Ambient Air Quality Standards (EPA Records Office, 1971 Air Pollution Standards Comments File).

their daily decisions.

Equally important was the effort to mobilize political strength for legislative revision. This came in the form of the Clean Air Coalition, which brought together representatives of many environmental organizations interested in clean air. Some of these were national groups, such as Friends of the Earth, the American Lung Association and the Sierra Club; others were state and local groups, such as New Mexico Citizens for Clean Air and Water or the Los Angeles Coalition for Clean Air. The Coalition organized the legislative defense of the Clean Air Act. It monitored the legislative process in Washington, kept its member organizations informed regarding the details of action, and mobilized citizens for input into each stage of legislation. Equally important, in the battle for information, it was able to ferret out technical data to influence the course of legislative thought and action.

Especially valuable to the defense of the 1970 Act was the support of groups which, although not integral parts of the Clean Air Coalition, worked in cooperation with it. While the Oil, Chemical and Atomic Workers Union was a Coalition member, having formed close ties with environmentalists on the common ground of protecting workers from pollutants in industry, other unions were not. Yet during the debate over the Clean Air Act, organized labor threw its weight in defense of the Act and against weakening it,[72] save for the major exception of postponing the automobile standards. This role reflected a failure by industry to win over labor fully to its side except in a few selected issues. By 1977 many segments of organized labor realized the adverse health impacts of polluted air at work and attempted to maintain a balance in the twin drives for jobs and clean air. On the jobs issue, they were drawn toward industrial management; on the clean air issue, toward environmentalists. Amid the intensity of the debate, they continued to maintain a middle ground, but refused to budge on the basic principles of the Clean Air Act. Even more surprising was the degree to which labor supported the principle of prevention of significant deterioration, not in itself a workplace issue. While organized labor was quite willing to work out agreements for a cleanup timetable which might extend beyond the previous requirements, it also insisted on prog-

72. See statement by John J. Sheehan, representative of the United Steelworkers of America, 7 Envir. Rep.—Current Dev. (BNA) 240 (June 11, 1976).

ress toward that end and was not willing to compromise the needed regulatory systems.[73]

A critical aspect of the give-and-take of political struggle in the evolution of the 1977 amendments was the role of the steel industry. This was one of the major industrial groups which remained to comply with the 1970 Act. Its slow progress was emphasized by a rather dramatic session which took place at hearings conducted on revision of the 1970 Act by the House Subcommittee on Health and the Environment, chaired by Rep. Paul Rogers of Florida.[74] At the meeting were representatives of the American Iron and Steel Institute, in the person of corporate leaders of the largest steel firms in the nation. Rep. Rogers asked each one, in turn, about the progress made by his firm in meeting clean air requirements. Were any sources in compliance? Each replied that, in fact, none were. The expression of shock from Rep. Rogers was repeated on later occasions; the episode was described in the Report of the House Committee and continued to play an important role in the somewhat negative attitudes toward the steel industry which persisted in Congress during enactment of the amendments.[75]

The United Steelworkers of America did not support industry in its attempt to weaken the Clean Air Act. While it persistently spoke of the need to protect jobs, it also refused to succumb to industry's claims that, if the law were implemented, a massive loss in jobs would result. Both labor and environmentalists referred to such threats as "blackmail," and described them as management tactics not in the interest of labor. On a variety of occasions, union representatives continued to maintain that environmental controls had not been responsible for job losses and that reduction of steelworker employment was due far more to new technology and increased

73. In the debate over the revision of the Clean Water Act during 1977, Lloyd McBride, President of the United Steel Workers of America, wrote, "Our union does not seek any congressional relaxation of the . . . EPA-OSHA regulations." See Letter from McBride to Rep. Charles J. Carney, Chairman of the Congressional Steel Caucus, Oct. 19, 1977. During debate over the "environment vs. jobs" referendum in Allegheny County, Pennsylvania, in the fall of 1977, USW representatives testified, "There is no evidence that changing the environmental laws would preserve steel industry jobs." *See* statement issued on behalf of Joseph Odorcich, Vice President of Administration, United Steelworkers of America, at a press conference, Pittsburgh, Pa., Oct. 21, 1977.

74. H. R. SUBCOMMITTEE ON HEALTH AND THE ENVIRONMENT, COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE, 94th Cong., Clean Air Act Amendments—1975, at 690.

75. *See* 1977 U.S. CODE CONG. & AD. NEWS 1289.

labor productivity.[76] After the amendments were passed in 1977, labor's own analysis of the Act's strengths and weaknesses was surprisingly similar to those made by environmentalists.[77] While the steelworkers were interested primarily in more healthful working conditions, they maintained a broader view of the importance of the clean air program in general.

The political struggle over the clean air program, as it evolved between 1970 and 1977, demonstrated the critical importance of scientific and technical capability as a key element of political strength. Increasingly, many issues turned on the ability to bring to the decision a convincing array of facts and arguments about the effects of cleaner air. On this score industry had resources, such as technical and legal staffs, which far outweighed those of environmentalists. The latter had to rely on studies conducted elsewhere, in government and the universities, and on experts beyond their own personnel who could be persuaded to join in the effort to protect and extend air quality programs. Legal defense organizations at times had a few "in-house" experts, but for the most part, few resources to employ such skills were available. Staff members could identify and utilize studies conducted elsewhere.

An emerging problem of extraordinary significance—the long-distance transmission and transformation of air pollutants—came into prominence during the debate over the amendments and pinpointed the political significance of research resources. This issue constituted a major example of the attempt to influence the direction of scientific inquiry. The problem was simple. Evidence was accumulating that a number of pollutants were transported for long distances, that in the process they were transformed into derivates more harmful than their precursors, and that they "fell out" in areas far distant from their place of origin. Neither EPA nor industry was oblivious to the significance of this, and both rushed to undertake studies of it. The electric utilities especially took up the challenge, since one of the major problems was sulfates. The issue was joined in one instance in the Ohio River Basin Energy Study, authorized by EPA, which focused research on the long-range effects of sources in the Ohio Valley. The utility industry objected to identification of the problem as a major factor to be taken into account in analyz-

76. *See* note 73 *supra*.
77. *See* note 53 *supra*.

ing the impact of the Valley's energy growth.[78] It seems apparent that the "facts" about long-range transport and transformation of air pollution would become the center of one of the most critical political air quality struggles in the ensuing years.

It was equally apparent that the struggle over the "facts" about health effects would be critical. The most immediate pending focus for that controversy was the revision of both the criteria documents and the standards. To industry it appeared that revision would discredit the earlier standards; they were convinced that health effects would be found to be far less severe than the earlier documents had concluded. To environmentalists, on the other hand, new data with respect to almost every pollutant fully justified the standards and perhaps even lower maximum contaminant levels. A major aspect of the anticipated struggle would be the balance in the range of scientific expertise which would be called upon to approve the criteria documents and the range of values which they expressed in their judgments. To a large extent, the crux of the political struggle lay in that choice.

CONCLUSION

As one reviews the historical development of air quality policies between the Acts of 1970 and the 1977 amendments, he is struck by the rapid evolution of the context of policy-making. First there was the persistent development of public values as reflected in the "prevention of significant deterioration" program, the successful litigation by environmentalists to supervise administration of the Act, and the equally successful defense and extension of the Act in the 1977 amendments. Those amendments were convincing evidence that the environmental movement, as it pertained to air quality, would not go away; they also helped to persuade environmentalists that they did reflect persistent public values and that they could mount effective political programs.

Second, there was the remarkable evolution of ideas and perspective which came with the extension of knowledge about air pollution. By 1977 this could still be described as rudimentary in comparison with what was desired to be known; yet it was far more exten-

78. *See* news release, Ohio River Basin Energy Study (Feb. 15, 1978); *see also* response, Sy A. Ali, Manager, Environmental Programs Public Service Company of Indiana, to Dr. Boyd R. Keenan, Ohio River Basin Energy Study (Mar. 7, 1978).

sive than what was known in 1970, and it established the contours of perception and thought which would shape air quality politics for the future. It was this perspective, arising from a far different "cognitive map" about the nature of air quality, which made the political setting of 1977 so vastly different from that of 1970. Much of the success of the environmental thrust lay in the evolution of this knowledge and its dissemination to the environmental public. The continuing inquiries which were connected with this expansion of knowledge set the stage for much of the politics of knowledge acquisition which constituted the focal point of struggles in the late 1970's.

Far less clear was the degree to which the debate over mechanisms of air quality control had led to significant changes. The move to bolster regulation with a noncompliance fee and a stiffer civil penalty authority was clear enough in the 1977 amendments. These were experimental, though, and gave rise to no strong confidence that they would lead to a new long-range context for air quality policy. During the 1975-77 debates over revision of the Act, one might well have looked for innovations in the technical context of air quality control. How could more socially desirable technologies be achieved more rapidly? There were a number of technical initiatives underway that appeared to be promising, and there were constant demands that private industry make greater progress toward cleaner technology. Little of this came to constitute a focus for national debate and vigorous policy initiatives.

The evolution of public debate over clean air from 1970 to 1977 reflected significant changes in public values and scientific perception, but technological perspectives lagged considerably. Perhaps it gave rise to a fundamental question: while public policy can reflect changes in public values to a considerable degree and can generate new scientific knowledge though public funds, can it also create in the private sector new and more socially desirable technologies?