Air Quality Modeling: Judicial, Legislative and Administrative Reactions

Bruce M. Kramer*

I. INTRODUCTION

The Clean Air Act Amendments of 1970[1] opened a new era in the battle against health-endangering air pollution by establishing stricter standards for air quality, and deadlines for meeting those goals.[2] The statutory mechanism was predicated on the setting of two air quality standards by the Administrator of the Environmental Protection Agency (EPA):[3] National Primary Ambient Air Quality Standards (Primary Standards) and National Secondary Ambient

* Professor of Law, Texas Tech University School of Law; B.A., UCLA (1968), J.D., UCLA (1972); LL.M., University of Illinois College of Law (1975).

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1. Clean Air Act Amendments of 1970, Pub. L. No. 91-604, 84 Stat. 1676 (1970). The 1970 Amendments were actually amendments to the 1967 Air Quality Act, Pub. L. No. 90-148, 81 Stat. 485 (1967). In reality the amendments so drastically and completely changed the earlier act that they are referred to as the 1970 Clean Air Act. The Clean Air Act Amendments of 1977, Pub. L. No. 95-95, 91 Stat. 685 (1977), in addition to making major additions and deletions from the 1970 Amendments (*see* text accompanying notes 136a-171 *infra*), recodified the entire statute at 42 U.S.C. §§ 7401-7642 (West Supp. 1978). The placement of the entire 1970 Amendments within the one section 1857 had required an unnecessarily complex system of letter and subsection citation. The statute is presently codified at 42 U.S.C. §§ 7401-7642 (West Supp. 1978).

2. The 1970 Amendments also refined the practical implementation of "cooperative federalism" in which federal and state governments assume both interdependent and independent roles in the statutory scheme designed to preserve our nation's air resources. *See, e.g.*, Luneberg, *The National Quest for Clean Air 1970-1978: Intergovernmental Problems and Some Proposed Solutions*, 73 NW. L. REV. 397 (1978); Ayres, *Enforcement of Air Pollution Controls on Stationary Sources under the Clean Air Amendments of 1970*, 4 ECOLOGY L.Q. 441 (1975) [hereinafter cited as Ayres]; Kramer, *The 1970 Clean Air Amendments: Federalism in Action or Inaction*, 6 TEXAS TECH L. REV. 47 (1974) [hereinafter cited as Kramer I].

3. 42 U.S.C.A. § 7409 (West Supp. 1978). For a detailed analysis, *see* Ayres, note 2 *supra*.

Air Quality Standards (Secondary Standards).[4] The Primary Standards were to be attained within three years of approval of a state implementation plan (SIP)[5] while the Secondary Standards were to be attained within a reasonable time.[6] Primary responsibility for regulating emissions from existing stationary sources was given to the states.[7] The Administrator, however, was directed to control the regulation of new stationary source emissions by promulgating new source performance standards.[8]

A principal impediment to the meeting of the prescribed statutory deadlines[9] was the time devoted to developing state implementation plans and obtaining EPA approval of the individual state plans. States, in order to develop SIP's, were faced with the task of translating the Administrator's Primary Standards into emission standards for individual stationary sources[10] and this process required the states to determine existing ambient air quality for all major pollutants.[11] Such a determination necessitated the use of air quality models that could utilize the information gathered and fore-

4. 42 U.S.C.A. § 7409 (West Supp. 1978).

5. Under § 7410, states are given the opportunity to develop air quality plans that include state and federal elements designed to achieve EPA air quality standards. These SIP's must then be submitted to the EPA for final federal approval. 42 U.S.C.A. § 7410 (West Supp. 1978).

6. 42 U.S.C.A. § 7410(a)(2)(A) (West Supp. 1978).

7. The states were given primary responsibility for regulating emissions in 42 U.S.C.A. § 7410 (West Supp. 1978). *See also* Kramer, note 2 *supra*.

8. 42 U.S.C.A. § 7411(f)(1) (West Supp. 1977).

9. *See* Kramer, *Economics, Technology and the Clean Air Amendments of 1970: The First Six Years*, 6 ECOLOGY L.Q. 161, 179-96 (1976) [hereinafter cited as Kramer II]; *see also* Ayres, note 2 *supra*. *Compare with* Bagge, *Coal and Clean Air Law: A Case for Reconciliation*, 4 ECOLOGY L.Q. 479 (1975).

10. *See generally* Bleicher, *Economic and Technical Feasibility in Clean Air Enforcement Against Stationary Sources*, 89 HARV. L. REV. 316, 325-26 (1975) [hereinafter cited as Bleicher]. In the original development of SIP control strategies, some states took an approach calling for no emission controls prior to the deadline. Most states, however, used an incremental approach. *See* Train v. Natural Resources Defense Council, Inc., 421 U.S. 60, 63-69 (1974). The incremental approach is now a mandatory part of all SIP's for non-attainment areas, 42 U.S.C.A. §§ 7501-7508 (West Supp. 1978).

11. States also were required to estimate total stack emissions from existing stationary sources. Bleicher, note 8 *supra*. Further, it was necessary for the states to appraise the effect on air quality of the federal motor vehicle emission standards for the automobile-related pollutants including photochemical oxidants, hydrocarbons, and nitrogen dioxide. 42 U.S.C.A. §§ 7501-7508 (West Supp. 1978). The effect of future emissions from new sources was still another mandatory consideration, because the level of emission control for these sources would be set by the federal government, not by the states. Bleicher, note 8 *supra*. Finally, extensive meteorological and topographical data were required to add to the aforementioned data to be incorporated into air quality models for a region. *Id.*

cast the impact of the thousands of emission sources on the existing ambient air quality.[12] These models would be vital tools in designing SIP's.

This article reviews the history of the use of predictive models[13] to ascertain the impact and relationship of a single emitter of air pollution on the ambient air. First, the early development of modeling techniques is examined. Second, trends in standards of judicial review of EPA decisionmaking in the area are charted.[14] Third, the article traces the evolution of air quality modeling into a more

12. Modeling is an attempt to simulate through any one of several different procedures the atmospheric processes that occur after the discharge of contaminants into the ambient or atmospheric air. The United States EPA Guidelines on Air Quality Models define a model as a "quantitative or mathematical representation or simulation which attempts to describe the characteristics or relationships of physical events." U.S. EPA, GUIDELINES ON AIR QUALITY MODELS, A1-A34, 48 (1978) [hereinafter cited as GUIDELINES].

13. *Id.* at 48. There are four basic types of models: Gaussian, numerical, statistical or empirical, and physical. Within each type there are an infinite number of individual models. Physical models attempt to simulate the atmospheric processes affecting pollutants on a small scale. A smog chamber is one type of physical model that has been used widely in the past twenty years. J.H. SEINFELD, AIR POLLUTION 32-33 (1975). Because physical modeling is highly complex and localized, the EPA Guidelines do not recommend their general use, although they do reserve judgment in individual cases. GUIDELINES, *supra* note 12, at 17. The statistical-empirical models are used where there is not enough data to use the Gaussian or mathematical models. *Id.* at 16-17. Empirical models are based on a statistical analysis of past air monitoring data, usually of several years duration. J.H. SEINFELD, AIR POLLUTION 33-34 (1975). The linear rollback model is a type of statistical-empirical model. Mathematical models are usually applied to urban airsheds where pollutants are emitted from many different sources. *Id.* at 34. These models attempt to simulate the dynamic processes occurring in the ambient air. *Id.* Gaussian models are closley related to numerical models but rely on a Gaussian plume dispersion. GUIDELINES, *supra* note 12, at 16-17. Gaussian models are most accurate in predicting the impact of emissions from a single source. *Id.*

14. The academic debate over the proper scope of judicial review has produced notable articles including some written by the judges most active in hearing and deciding environmental litigation. *See, e.g.*, Leventhal, *Environmental Decisionmaking and the Role of the Courts*, 122 U. PA. L. REV. 509 (1974); Wright, *The Courts and the Rulemaking Process: The Limits of Judicial Review*, 59 CORNELL L. REV. 375 (1974); Friendly, *Some Kind of Hearing*, 123 U. PA. L. REV. 1267 (1975). *See also* Stewart, *The Development of Administrative and Quasi-Constitutional Law in Judicial Review of Environmental Decisionmaking: Lessons from the Clean Air Act*, 62 IA. L. REV. 713 (1977) [hereinafter cited as Stewart]; Kramer II, note 9 *supra*.

Several decisions of the District of Columbia Court of Appeals have served as an arena for this debate. *See, e.g.*, Ethyl Corp. v. EPA, 541 F.2d 1 (D.C. Cir. 1976), *cert. denied*, 426 U.S. 941 (1976); National Asphalt Pavement Assoc. v. Train, 539 F.2d 775 (D.C. Cir. 1976); International Harvester Co. v. Ruckelshaus, 478 F.2d 615, 650 (D.C. Cir. 1973) (Bazelon, C.J., concurring); Essex Chemical Corp. v. Ruckelshaus, 486 F.2d 427 (D.C. Cir. 1973).

complex technique. Fourth, it explores the impact of the Prevention of Significant Deterioration Program on modeling and the beginning of express Congressional acceptance of air quality modeling as a means of achieving the goals of the Clean Air Act Amendments of 1977.[15]

II. The Early History of Modeling—Administrative Assumptions in Lieu of Adequate Air Quality Data

The 1970 Amendments did not specifically sanction the states' use of air quality modeling techniques in their preparation of SIP's. The Amendments did, however, require the states to develop programs to monitor air quality as part of the SIP.[16] In order to assist the states in this and other duties that formulating an SIP entailed, the Administrator of the EPA published an initial set of regulations.[17] The Administrator also established a priority system that determined the precise level of controls immediately required in each Air Quality Control Region (AQCR).[18] The Administrator was concerned with the scarcity of manpower, expertise, and funds.

The priority system designated three categories. The first category, Priority I, included those regions where the air was most polluted and therefore needed the greatest amount of EPA and state attention.[19] The second category, Priority II, only applied to sulfur dioxide and particulate matter, and was to be employed where the ambient concentrations of these pollutants were in violation of the Primary Standards. A moderate level of clean-up and monitoring was required in Priority II areas.[20] In Priority III areas, deemed to be the least polluted, little or no effort was to be expended either to control existing sources of air pollution or to re-

15. Clean Air Act Amendments of 1977, Pub. L. No. 95-95, 91 Stat. 685 (1977).

16. Clean Air Act Amendments of 1970, § 110(a)(2)(C), 84 Stat, 1680 (currently codified at 42 U.S.C.A. § 7410(a)(2)(C) (West Supp. 1977)). A General Accounting Office Study in 1978 raises the issue of the the adequacy of the air quality monitoring system eight years after the passage of the 1970 Amendments. U.S. Gen. Accounting Office, An Executive Summary: 16 Air and Water Pollution Issues Facing the Nation 22-23 (1978).

17. 36 Fed. Reg. 22,399 (1971).

18. Air Quality Control Regions are geographic divisions, each region having its own air quality and air quality control strategy. Strategies to control a specific region depend on whether the area in question is an attainment or non-attainment area. See 42 U.S.C.A. § 7407 (West Supp. 1978).

19. 36 Fed. Reg. 22,399 (1971).

20. *Id.* at 22,400-01.

quire air quality monitoring for hydrocarbons, oxidants, nitrogen oxides, and carbon monoxide.[21]

AQCRs were classified as Priority I, II, or III, depending upon the level of air pollutants in the area. Since air quality data were often unavailable, the Administrator of the EPA was forced to utilize substitute procedures for the purpose of channelling clean-up efforts. For two pollutants, sulfur oxides and particulate matter, he proposed the use of two air quality models to obtain an estimated figure for the ambient air quality of the AQCR.[22] The first model was called an "area model" and was designed to appraise ambient concentrations caused by diverse and diffused point sources of pollution. It was a relatively simple technique and did not need a computer for adequate implementation; the only data essential to the operation of the model were the estimated concentration of the pollutant, the wind speed through the mixing layer, the emission density, and the urban size of the area in question.[23] The second model was a point model, designed to measure ambient air concentrations that could be attributed to a single source. Although somewhat more complex than the area model, the point model was also rather simplistic in design and was to be used to ascertain the short-term Primary Standards.[24]

Where measured data for oxidants, hydrocarbons, nitrogen oxides, and carbon monoxide were missing for an area, the EPA did not propose to employ a model in order to categorize the AQCR. Instead it classified those areas with a population in excess of 200,000 as "urban places" and as Priority I. All other areas were declared to be in the Priority III category.[25] An AQCR that was placed in the Priority I grouping due to population size could be reclassified to Priority III if the region could prove, through monitoring, that its ambient air quality was not in violation of the established numerical limits.[26]

21. *Id.* at 22,402.

22. *Id.* at 22,405.

23. *Id.* When compared to some of the models now in use requiring complex computer analysis, it is technically correct to label these initial EPA modeling efforts as "primitive." *See, e.g.*, GUIDELINES, note 12 *supra*; U.S. EPA, Workbook for Comparison of Air Quality Models (1978); U.S. EPA, Workbook for Comparison of Air Quality Models—Appendices (1978).

24. 36 Fed. Reg. 22,398, 22,405 (1971).

25. *Id.* at 22,399.

26. *Id.* The Administrator also recommended that SIP's incorporate an air quality model developed by the EPA to estimate its amount of motor vehicle emissions for urban areas. *Id.* at 22,412.

The EPA Administrator supported the use of the "urban place" population figure as a cut-off for two reasons. First, in order to attain vehicular Primary Standards, traffic patterns would have to be controlled and controlling traffic was easier in larger cities having greater areal authority.[27] Second, the Administrator alleged that because of the time limit imposed by Congress, the lack of necessary data, and the administrative impossibility of attacking all of the nation's air pollution problems at once, it was necessary to adopt this simplistic standard.[28]

The EPA's classification assumptions were attacked in *Natural Resources Defense Council v. EPA*[29] (*N.R.D.C. I*). In that case, petitioners before the First Circuit challenged the Administrator's categorization of the Providence, Rhode Island area as a Priority III region for photochemical oxidants and carbon monoxide, a classification that required no further action by the EPA or state authorities. The central or core section of Providence had a population of only 170,000 persons and thereby qualified under the population test as a Priority III area. Petitioners argued, however, that Providence's metropolitan area had a population of well over 570,000 and should therefore be deemed an urban place requiring Priority I classification.

The *N.R.D.C. I* court refused to presume conclusively that the Administrator was correct in his classification assumption.[30] Instead, it required further data and supporting facts so that it could ascertain whether the agency had made a reasoned judgment.[31] The case was therefore remanded to the Administrator for the presentation of newly discovered data with regard to the actual air quality in Providence. The court stressed that the Providence AQCR would be classified by utilizing the new data rather than the

27. Natural Resources Defense Council v. EPA, 478 F.2d 875, 880 (1st Cir. 1973).

28. *Id.* The main difficulty with using the "urban place" basis for classification as Priority I was that such classification, although somewhat arbitrary, resulted in harsh ramifications. Priority I areas had to adopt strict control strategies for obtaining Primary Standards for the motor-vehicle caused pollutants by 1975. 36 Fed. Reg. 22,402 (1971); *see also* Santa Rosa v. EPA, 534 F.2d 150, 152 (9th Cir. 1976); Chernow, *Implementing the Clean Air Act in Los Angeles: The Duty to Achieve the Impossible*, 4 ECOLOGY L.Q. 537 (1975). Despite such significant consequences, no empirical studies supported the Administrator's decision to use the 200,000 urban place population assumption. Natural Resources Defense Council v. EPA, 478 F.2d 875, 881 (1st Cir. 1973).

29. Natural Resources Defenses Council v. EPA, 478 F.2d 875 (1st Cir. 1973).

30. *Id.* at 881. If the court had refused to question EPA decisionmaking, it would have removed the judiciary from any effective exercise of judicial review.

31. *Id.*

Administrator's assumptions.[32] If sufficient data were still unavailable, the EPA was directed to provide the court with a detailed statement of reasons supporting the use of the "urban place" assumption and the 200,000 cut-off figure.[33]

The next case to examine the Administrator's use of assumptions to replace unattainable but necessary factual data was *Natural Resources Defense Council v. EPA*[34] (*N.R.D.C. II*). There, petitioners before the Second Circuit attacked the Administrator's approval of the New York SIP, claiming that because the formula used to develop the SIP included erroneous factual assumptions, the Primary Standards for sulfur oxides would not be met.[35] The EPA had theorized that restrictions on the sulfur content of coal in the New Jersey SIP would cause a discontinuance of coal use and that all coal-burning power plants would convert to oil-fired boilers.[36] If these conjectures were true, the prevailing westerly winds that transported air pollutants to New York would carry fewer sulfur oxides.

The Second Circuit, in *N.R.D.C. II*, concluded that the assumptions utilized in the models were unpersuasive and unrealisitic because of the then existing oil shortage.[37] It therefore remanded the EPA's decision on the sulfur dioxide portion of the SIP for further

32. *Id.* at 893.

33. *Id.* at 882. The remand for a detailed statement of reasons supporting the Administrator's position even in the absence of a congressional requirement for one has been a popular approach for courts reviewing Clean Air Act cases. *See* Kennecott Copper Corp. v. EPA, 462 F.2d 846, 848-50 (D.C. Cir. 1972); Natural Resources Defense Council v. EPA, 475 F.2d 968, 971 (D.C. Cir. 1973); Buckeye Power Co. v. EPA, 481 F.2d 162, 171 (6th Cir. 1973); International Harvester Co. v. Ruckelshaus, 478 F.2d 615, 627 (D.C. Cir. 1973); Appalachian Power Co. v. EPA, 477 F.2d 495, 506-08 (4th Cir. 1973); Natural Resources Defense Council v. EPA, 478 F.2d 375, 381-82 (1st Cir. 1973); Cincinnati Gas & Electric Co. v. EPA, 578 F.2d 660 (6th Cir. 1978).

34. 494 F.2d 519 (2d Cir. 1974).

35. *Id.* at 525-26.

36. *Id.* In estimating its need for reduction of sulfur dioxide emissions, New York had used simple rollback calculations. These were rejected by the EPA, which used its more sophisticated computer diffusion models. *Id.* Diffusion models attempt to describe and predict the physical and chemical behavior of pollutants in the ambient air. A computer diffusion model is merely a mathematical model which has been placed on a computer program that describes the "spatial and temporal history of contaminants released into the atmosphere." J.H. SEINFELD, AIR POLLUTION 260, 261-351 (1975). The EPA defines the simpler rollback model as one that "assures that if emissions from each source affecting a given receptor are decreased by the same percentage or amount, air quality concentrations decrease proportionately." GUIDELINES, *supra* note 12, at 48.

37. Natural Resources Defense Council v. EPA, 494 F.2d 519, 526 (2d Cir. 1974).

explanation. The EPA was instructed to disapprove the New York SIP unless it could (1) explain more completely why its original assumptions were valid under present circumstances, or (2) justify why the change in assumptions concerning the New Jersey emissions would not significantly alter the result of the previously used air quality models, or (3) recalculate a full-scale diffusion model analysis on a valid range of assumptions, any of which would demonstrate that the SIP for New York would sufficiently achieve Primary Standards for sulfur dioxide.[38]

III. Air Quality Models' First Direct Encounter with Judicial Review

The first case that dealt directly with the EPA's use of air quality modeling was *Texas v. EPA*.[39] That case arose after the EPA rejected the Texas SIP for failing to meet Primary Standards for photochemical oxidants and promulgated its own regulations designed to achieve the required Primary Standards.[40] Texas alleged that both the EPA's rejection of the Texas plan and the agency's substitute SIP were arbitrary.[41] The state based its objections on the EPA's failure to use a reduction model curve[42] to determine how great a reduction in hydrocarbon emissions was necessary to achieve Primary Standards for photochemical oxidants, and on the EPA's estimates of the efficacy of various measures of stationary source control in achieving the required reduction.[43]

Of particular importance is the *Texas* court's decision as to the proper scope of review of the EPA's modeling choice. Because the Clean Air Act itself did not specify a standard of review, the court opted for a test that was first applied by the United States Supreme Court in *Citizens to Preserve Overton Park, Inc. v. Volpe*.[44] That test dictates that where the Administrative Proce-

38. *Id.*

39. 499 F.2d 289 (5th Cir. 1974), *cert. denied*, 427 U.S. 905 (1976).

40. The 1970 Amendment specifically authorized the Administrator to promulgate substitute SIP's where the states have either failed to act or have acted in an unsatisfactory manner. Pub. L. No. 91-604 § 110(c)(i), 84 Stat. 1676, 81-82 (current version: 42 U.S.C.A. § 7410(c) (West Supp. 1977).

41. Texas v. EPA, 499 F.2d 289, 294 (5th Cir. 1974).

42. A reduction model curve permits regulators to predict the processing of hydrocarbons at various processing facilities in an area. By using this model one can determine how various hydrocarbon emissions and concentrations affect air quality. *Id.* at 294-95.

43. *Id.* at 295.

44. 401 U.S. 402 (1971). The 1977 Amendments have subsequently affirmed the use of the *Overton Park* test for regulating specified EPA regulations. Pub. L. No. 95-95,

dure Act's statutorily-mandated judicial review provisions for designated agency actions are inapplicable, as was the situation here because the selection of a particular air quality model or models is neither an adjudicatory nor a rule-making proceeding,[45] the court should make three inquiries. These are: (1) whether the action was within the scope of the agency's authority; (2) whether the agency conformed to procedural requirements; and (3) whether the agency's decision was arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law.[46] In most instances, it is this third inquiry that is the heart of the judicial review process.

In determining what is arbitrary, capricious, or an abuse of discretion, the court must consider whether the decision made by the administrative agency was "based on a consideration of the relevant factors and whether there was a clear error of judgment."[47] It is also a maxim of administrative law that a court is not to substitute its judgment for that of the agency merely because it thinks a better decision could have been made.[48] On the other hand, the *Texas* opinion emphasized that a court should not merely rubber stamp the agency's actions. Thus, the *Texas* court was placed in the difficult position of reviewing the procedures used by the agency

§ 305(a), 91 St. 685 (current version: 42 U.S.C.A. § 7607(d) (West Supp. 1977)). But one commentator has suggested that the "arbitrary, capricious or abuse of discretion" standard, while typically applying to the informal "notice and comment" type rulemaking used by the EPA, should not be applied to most Clean Air Act rulemaking because in the latter there is an extensive "paper record" while in the former there is a lack of any evidentiary record. Stewart, *supra* note 17a, at 738.

The United States Supreme Court in Vermont Yankee Nuclear Power Corp. v. Natural Resources Defense Council, Inc., 435 U.S. 519 (1978), has disagreed with Professor Stewart's plea that courts take a "hard look" at agencies' technical decisions. In a sharply worded opinion, Justice Rehnquist rebuked the District of Columbia Court of Appeals for taking a "hard look" and requiring more procedural safeguards than mandated by statute. *Id.* at 543-49. For Professor Stewart's rejoinder, *see* Stewart, *Vermont Yankee and the Evolution of Administrative Procedure*, 91 HARV. L. REV. 1805 (1978); *but cf.* Byse, *Vermont Yankee and the Evolution of Administrative Procedure: A Somewhat Different View*, 91 HARV. L. REV. 1823 (1978); *and* Breyer, *Vermont Yankee and The Courts' Role in the Nuclear Energy Controversy*, 91 HARV. L. REV. 1833 (1978).

45. 5 U.S.C. §§ 551-559, 701-706 (1976). The Administrative Procedure Act imposes the "substantial evidence" test for judicial review of formal rulemaking and adjudicatory proceedings of administrative agencies. *Id.* § 706(2)(E). Informal rulemaking proceedings are to be reviewed by the courts using an "arbitrary, capricious, or abuse of discretion, or otherwise not in accordance with law" standard. *Id.* § 706(2)(e).

46. Citizens to Preserve Overton Park, Inc. v. Volpe, 401 U.S. 402, 415-17 (1971).

47. *Id.* at 416.

48. *Id.*

and approving or rejecting the outcome regardless of whether the court agreed or disagreed with the decision.[49]

Having determined the scope of judicial review, the *Texas* court addressed the substantive issues. The principal substantive issue considered was how large a percentage reduction of hydrocarbon emissions was necessary to achieve the Primary Standards for photochemical oxidants in certain AQCRs.[50] Texas did not dispute the EPA's findings on background levels of oxidants.[51] The EPA and Texas had used different models and therefore had arrived at divergent determinations.

Texas alleged that its model was more sophisticated in its use of methodological systems because it was based, not on total hydrocarbon emissions, but only on reactive hydrocarbons, i.e., those which react with nitrogen oxides to form oxidant pollutants.[52] Reactive hydrocarbons, however, had not been studied in their application to an appropriate reduction model.[53] The EPA had therefore concluded that the Texas reduction curve was not supported by technical data and had instead utilized a straight rollback model. The agency had determined the rollback model to be the most reasonable choice under the circumstances because this model is generally used where inadequate information prevents the use of other more complex, and presumably more accurate, models.[54]

The straight rollback model is based on the principal assumption that reductions in oxidant pollutants will be proportional to reductions in reactive hydrocarbon emissions. Hence the name straight rollback model. The EPA had concluded, without justification in the record, that a maximum oxidant level of .08 parts per million (the Primary Standard) would be associated with a non-methane hydrocarbon concentration of approximately .17 parts per million.[55] However, no reliable tests proved the connection between hydrocarbon emissions and relatively low ambient levels of oxidant pollution. Texas, on the other hand, assumed the appropriate figures for non-methane hydrocarbon concentrations were either .20 or .21

49. The full record in Texas consisted of some 10,000 pages of highly technical material, Texas v. EPA, 499 F.2d 289, 297 (5th Cir. 1974). *See also* International Harvester Co. v. Ruckelshaus, 478 F.2d 615, 650-51 (D.C. Cir. 1973) (Bazelon, C.J., concurring).

50. Texas v. EPA, 499 F.2d 289, 293 n.3 (5th Cir. 1974).

51. *Id.* at 295.

52. *Id.*

53. *Id.* at 298.

54. *Id.*

55. *Id.* at 299 n.13.

parts per million.[56] Use of the Texas figures rather than the EPA ones would result in the allowance by the SIP of a significantly higher amount of stationary source hydrocarbon emissions.

The EPA, in its argument before the *Texas* court, did not contend that its model was a precise or accurate representation of reality.[57] Rather, it argued that the use of the more complicated and untested Texas model should be rejected where that model led to marked differences with the more scientifically accepted, if simpler, rollback model. The EPA asserted that Texas had not supplied any technical or scientific support for the use of its model or the reason for the different result, leading the EPA to the conclusion that its rather simplistic straight rollback model constituted a reasonable resolution of the problem.

The *Texas* court agreed that Texas had not given any theoretical or empirical support for its new model. The court also noted a basic inconsistency in the use of the Texas reduction curve model: it was purported to be appropriate for non-reactive hydrocarbons, yet the data utilized were for non-methane hydrocarbons, which are an entirely different group of elements and may possess different properties. Moreover, although the EPA model may not have been an accurate representation of reality, it still had been promulgated as part of an agency regulation subject to prior public scrutiny and comment. The Texas model had not been put through this public review process, and in the court's opinion, the appropriate time for interested parties to have indicated the availability of alternative models was when the SIP was made available for public comment and review. It therefore concluded that the rejection of the Texas model by the EPA was not arbitrary or capricious.[58]

The court next examined the question of whether the EPA's projections were arbitrary or capricious.[59] The *Texas* court was favorably impressed by the fact that the straight rollback model was neutral, in that it presented a common sense approach to a problem that had not yet been scientifically explored. It felt that deviations from this practical approach were to be permitted or required only when supported by empirical data or sound scientific theory,[60]

56. *Id.*

57. *Id.* at 298.

58. *Id.* at 301.

59. *Id.* Because the EPA was forced to develop its model and attain Primary Standards in a very brief period of time, the court was convinced that judicial insistence on greater reliability was inappropriate. Therefore, the Texas court did not investigate the accuracy of the EPA's projections.

60. *Id.*

and that in this case, Texas had failed to present such support.[61] For these reasons the *Texas* court held that the EPA's decision to accept the simplistic straight rollback model[62] was non-arbitrary and non-capricious. Although the court was initially uneasy about utilizing a model based on simplistic assumptions which would be the basis for "wide-ranging" governmental action, it found that no other feasible alternatives would allow the EPA to devise an SIP capable of attaining Primary Standards within the statutorily mandated period.[63]

Subsequently, the *Texas* court addressed the EPA's rejection of the Texas "reactivity factors"[64] to determine the reactive components of the gross emissions of hydrocarbons for the state. Reactivity factors affect the amount of emission reduction needed to achieve Primary Standards for photochemical oxidants.[65] In developing its set of reactivity factors, the EPA used empirical data developed for Los Angeles and Louisiana chemical processing and petroleum refining industries. Those reactivity factors, however, were markedly different from the ones proposed by the state of Texas. The court resolved this issue by placing the burden of proof on the state to show why the EPA's figures were inappropriate.[66] Because the State did not provide sufficient evidence in a sound and orderly manner, the court again held that the EPA's decision was not arbitrary or capricious.[67]

Petitioners also attacked the EPA's choices of a petroleum refinery industry reactivity factor and reactive inventory. The EPA again based its figure on some dated Louisiana and Los Angeles

61. In fact, Texas tried to have the best of both worlds by claiming that for the two AQCRs where the Texas model required a greater degree of emission control it would agree to the EPA's use of the straight rollback model. *Id.* at 301.

In most cases courts require the party attacking the agency decision to shoulder the burden of proof on the "arbitrary, capricious or abuse of discretion" issue. SCHWARTZ, ADMINISTRATIVE LAW 349-52 (1976).

62. Texas v. EPA, 499 F.2d 289, 301 (5th Cir. 1974).

63. *Id.* The court never lost sight of the explicit congressional mandate making the protection of the public health a priority goal of the 1970 Amendments. *See also* Ethyl Corp. v. EPA, note 14 *supra*.

64. Reactivity factors describe the rate at which some hydrocarbons react with the atmosphere and sunlight. Hydrocarbons that are less reactive than others will retain the molecular characteristics of hydrocarbons. The more reactive ones will not. Reactivity factors predict the reactivity rate of hydrocarbons and the effect any changes in molecular structure will have on emissions of these molecules into the ambient air. Texas v. EPA, 499 F.2d 289, 304 (5th Cir. 1974).

65. *Id.* at 301-03.

66. *Id.* at 303. *See* note 64 *supra*.

67. Texas v. EPA, 499 F.2d 289, 303 (5th Cir. 1974).

studies. The EPA chose the more restrictive number without any explanation of its choice. The State charged that the study upon which it was based was dated, outmoded, and incorrectly applied. The EPA did not respond to any of the objections made by Texas. The court ordered the EPA to explain more fully its rejection of the Texas analysis. It remanded the decision to the EPA to determine whether or not there was any substantive merit in petitioner's claims. Overall, the *Texas* court was deferential in its substantive review of EPA modeling decisions and choices. In addition, by placing the burden of proof on Texas, the court reinforced its limited role in reviewing complex agency decisions.[68]

Another attack upon a federally promulgated SIP was litigated before the First Circuit in *South Terminal Corp. v. EPA*.[69] In this instance the EPA had promulgated an SIP designed to reduce expected emissions of hydrocarbons in the metropolitan Boston region by fifty-eight percent and of carbon monoxide in the same region by forty percent. Like the Fifth Circuit in *Texas*, the *South Terminal* court utilized the scope of review set forth in *Overton Park* which calls for the setting aside of agency action only when it is arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law. The court reiterated the need for a stringent and careful inquiry into the record while adhering to the *Overton Park* role of a rather limited review of the issues.[70]

Several aspects of the air quality modeling techniques employed by the EPA in *South Terminal* were attacked by petitioners. Chiefly criticized was the EPA's data base for proposed hydrocarbon emission reduction. It had used a single day's readings from a monitoring device measuring the hydrocarbon concentrations in the ambient air in the Boston area and incorporated data from the readings into the rollback model. The court concluded that the use of a single day's readings from a possibly malfunctioning machine was insufficient to support the EPA's photochemical oxidant determination.[71] It held, therefore, that the EPA plan was based on a clear error of judgment under the *Overton Park* rule and remanded to the Administrator for further action.[72]

The *South Terminal* petitioners also challenged the accuracy of the use of the rollback model itself with respect to hydrocarbon

68. *Id.*
69. South Terminal Corp. v. EPA, 504 F.2d 646 (1st Cir. 1974).
70. *Id.* at 655.
71. *Id.* at 662.
72. *Id.* at 666.

emissions, claiming that it failed to take into account local, topographical, and meteorological conditions. The EPA, however, submitted a technical support document indicating that it had considered these influences. The *South Terminal* court concluded that the mere fact that there are conflicts as to the use of the model does not justify the court's substitution of its judgment for that of the EPA. Therefore, the court affirmed the use of the rollback model for hydrocarbon and photochemical oxidant pollution.[73]

Another issue debated in *South Terminal* was the amount of reduction of carbon monoxide emissions needed to meet Primary Standards.[74] Again the attack was bifurcated, one prong addressing the accuracy of the data showing existing carbon monoxide concentrations in the ambient air, and another examining the use of the rollback model. Not only had the EPA utilized data collected from a single monitoring station, but it also employed as its base figure a single reading that had come out nearly fifty percent higher than the next highest reading from that station.[75] Petitioners sought to discredit the carbon monoxide reading by emphasizing internal EPA guidelines concerning location of the monitoring device. Apparently the monitoring device was somewhat closer to the street curb than the guidelines seemed to recommend. The court was not concerned with the location of the monitoring device, because the EPA guidelines also warned that monitoring locations will vary for practical considerations and thus it may not always be possible to meet all of the recommended guidelines. The court remanded the EPA decision,[76] overcoming the judicial reluctance to overturn technical agency decisions in an area of the agency's expertise.[77] The EPA was ordered to hold another public hearing and allow for an expanded record that was to include both input from the petitioners and further explanations by the EPA of its measurements and methodology.[78]

73. *Id.* at 662-63.
74. *Id.* at 663.
75. *Id.*
76. South Terminal Corp. v. EPA, 504 F.2d 646, 666 (1st Cir. 1974).
77. *Id.* at 665.
78. Because the Clean Air Act requires appellate rather than trial court review of most EPA decisions, the court cannot hold evidentiary hearings to answer the complicated technical questions involved in each case. *Id.* at 666; 42 U.S.C.A. § 7607 (West Supp. 1978). The appellate court's only recourse in this situation is to remand the decision to allow all parties to comment on these difficult questions facing the agency.

In a similar case, *Mision Industrial, Inc. v. EPA*,[79] petitioners before the First Circuit challenged the EPA's approval of the SIP for Puerto Rico, arguing that the predictive methodology used in drafting the plan permitted too great a likelihood of error.[80] The EPA's diffusion model had a random error capability as high as 150% for the annual average of pollutant emissions and 200% for short-term concentration; development of the necessary control strategies had a twenty percent margin of error.[81] Moreover, petitioners argued that because EPA's diffusion model did not properly account for the rough terrain and wind turbulence in Puerto Rico, even a higher margin of error was appropriate. Despite the strength of petitioners' challenges, the First Circuit concluded that great deference was owed the EPA in its area of expertise, and the court refused to substitute its judgment for that of the Administrator.[82] The court, without engaging in as "searching and careful" an inquiry as was utilized in *Texas* and *South Terminal*, seemed to distrust the technical claims of those attacking EPA modeling methodology.

In all three cases, *Texas*, *South Terminal*, and *Mision Industrial*, the courts recognized that the modeling used was crude, much dispute existed concerning background data, and the EPA was under tremendous time pressure because of the mandates of the 1970 Amendments.[83] In addition, these courts were faced with two somewhat contradictory judicial guidelines: (1) the court is not to substitute its judgment for that of the agency, and (2) the judicial inquiry into the facts and decisionmaking process must be "searching and careful."[84] The courts chose to follow the congressional mandate to bring the quality of our air to health-preserving levels even if great costs are involved.[85] Their standard of review, there-

79. 547 F.2d 123 (1st Cir. 1976).

80. *Id.* at 128.

81. *Id.*

82. *Id.* at 129.

83. In *Texas* and *South Terminal* the finding would require the imposition of transportation control plans reducing the vehicle miles traveled in the impacted regions. In *South Terminal*, the Administrator had proposed an on-street parking ban during working hours in the Boston core area, a parking surcharge, and other drastic alternatives. South Terminal Corp. v. EPA, 504 F.2d 646, 656-58 (1st Cir. 1974). In *Texas*, the necessary control strategies were expensive but not nearly as drastic as in *South Terminal*. Texas v. EPA, 499 F.2d 289, 312-18 (5th Cir. 1974).

84. *See* SCHWARTZ, ADMINISTRATIVE LAW (1976); Citizens to Preserve Overton Park, 401 U.S. 402, 415-17 (1971). *See* text accompanying notes 48-54 *supra*.

85. Texas v. EPA, 499 F.2d 289 (1st Cir. 1974). *See generally* Kramer II, note 7 *supra*.

fore, favored the result that gave the greatest protection to the public health, with the possibility of revision at a later date should the EPA's initial decision be erroneous.[86] The judiciary's presumption in favor of agency expertise gave the EPA a distinct advantage over any challengers of agency air quality modeling decisionmaking both in modeling's initial, and later, more sophisticated, stages.

IV. The Third Tier—Complex Models and Complex Decisions

Following the *Texas* and *South Terminal* decisions, the EPA began to develop more complex models to resolve more complicated air quality problems.[87] The agency's use of these models led to another round of litigation. In *Cleveland Electric Illuminating Co. v. EPA*[88] petitioners based their objections to the EPA-promulgated sulfur dioxide SIP for the State of Ohio[89] on the EPA's use of the Real-Time-Air-Quality Simulation Model (RAM) in the preparation of the SIP.[90] Acting under the same *Overton Park* standard of re-

86. *Cf.* Ethyl Corp. v. EPA, 541 F.2d 1 (D.C. Cir. 1976).

87. The list of references in the EPA's GUIDELINES publication names numerous government research and government-sponsored private research projects on air quality models. GUIDELINES, *supra* note 12, at 43-47.

88. 572 F.2d 1150 (6th Cir.), *cert. denied*, 435 U.S. 996 (1978).

89. Ohio has been the focal point for litigation that has caused innumerable delays in the attainment of Primary Standards for sulfur dioxide. *See* Kramer, *The 1977 Clean Air Act Amendments: A Tactical Retreat from the Technology-Forcing Strategy?*, 15 URB. L. ANN. 103, 114-15 n.61 (1978).

90. Cleveland Electric Illuminating Co. v. EPA, 572 F.2d 1150, 1160 (6th Cir. 1978). RAM is one of the recommended EPA models. GUIDELINES, *supra* note 14, at A17-A24. The RAM is a dispersion model developed to evaluate the impact of several point sources on the ambient air quality and operates on the assumption that each plant functions 24 hours a day at full capacity. Unlike models discussed earlier, RAM begins with a solid ascertainable data base. This data base, composed of the established design capacity of the relevant power plants and the type and sulfur contents of fuel used by each plant, required the inclusion of such factors as the capacity of each plant on a stack-by-stack basis, individual smokestack height, surrounding terrain, and weather conditions. Because of the additional data requirements for RAM, the computer analysis used is quite complex.

Unlike simpler models, the RAM and other dispersion models allow a determination of the cause-effect relationship between sulfur dioxide emissions and resulting ambient air quality. Modern dispersion modeling allows individual emission limitations that in turn minimize over-control of emissions but still ensure attainment and maintenance of Primary Standards. Cleveland Electric Illuminating Co. v. EPA, 572 F.2d 1150, 1161-62 (6th Cir. 1978).

The new SIP for sulfur dioxide control, based on the RAM projections showed less stringent regulation on a county-by-county basis that the earlier SIP's based upon the straight rollback model although RAM tended to require more stringent sulfur dioxide control overall. *Id.* at 1162-64.

view used in *South Terminal* and *Texas*,[91] the *Cleveland Electric* court tackled the issue of whether the use of the RAM was arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law. The court pledged that it would not substitute its judgment for that that of the agency, and indicated that affirmance of the agency action would be required if the court found a "rational basis" for such action.[92]

The *Cleveland Electric* court refused to enter the speculative game of determining whether RAM was the best possible approach for developing a sulfur dioxide SIP. Rather, it compared RAM to the more simplistic rollback model, and found several significant points to support the EPA's selection of the former over the latter. First, in addition to providing gross emission limits for the entire SIP, as did the earlier rollback models, the RAM could also be applied to individual sources of pollution to derive specific emission limits.[93] Second, the EPA's design or RAM was brought about at least in part by Ohio's request for greater specificity and lower costs of compliance in the attainment of Primary Standards,[94] and RAM appeared to have achieved these goals. The court emphasized that the decision to use RAM was a subject of vigorous public hearings.[95]

Petitioners next tried to show that the choice of RAM was arbitrary because of its allegedly unproven predictive capabilities. First, certain data already collected for the city of Dayton, Ohio was offered in evidence to show that RAM was not an accurate forecaster of air quality.[96] The court held that predictive perfection was not required because of the relatively recent development of air quality models, and that the use of RAM and its figures, if conservatively applied, was not arbitrary, capricious or an abuse of

91. *See* text accompanying notes 48-57 *supra*.

92. Cleveland Electric Illuminating Co. v. EPA, 572 F.2d 1150 (6th Cir. 1978).

93. As is noted by the *Cleveland Electric* court, the rollback model was the subject of strenuous objection by many of the petitioners at the earliest Ohio public hearing because it tended to require more stringent sulfur dioxide controls than other models. In fact, several key witnesses on behalf of the utilities bringing this lawsuit, testified at this Ohio SIP hearing that a more sophisticated modeling system would be favored. The development of the RAM was in response to these very arguments.

94. Cleveland Electric Illuminating Co. v. EPA, 572 F.2d 1150, 1160-64 (6th Cir. 1978).

95. *Id.* at 1161-62.

96. *Id.* at 1163. These data showed that for several years the second highest ambient concentration of sulfur dioxide each of those years and at six different sites was lower than RAM had predicted it to be.

discretion.[97] Second, it was alleged that certain RAM forecasts and the actual monitoring results from three counties showed gross overpredictions when RAM was used. The *Cleveland Electric* court, however, pointed out that most of the discrepancies appeared to have been caused by data errors factored into the RAM predictions and not the model itself. The court emphasized, further, that even if, as petitioners charged, the RAM model overpredicted emissions rates somewhat, the Clean Air Act's overriding purpose, which was the protection of health and life, would be substantially fulfilled by the use of the model.[98] Use of RAM was therefore held to be a rational choice, well within the discretionary powers given to the EPA in the Clean Air Act.[99] The petitioners had not sustained their burden of proof on the issue of whether the use of RAM was arbitrary, capricious, or an abuse of discretion.

Although the *Cleveland Electric* court claimed to be applying the rather limited *Overton Park* scope of judicial review, it actually employed a more searching judicial scrutiny. The issues should have been the reasonableness of the model, its technical and scientific basis, and the accuracy of the data supplied to the model. In considering the economic impact of the use of RAM by comparing the RAM with rollback model emission limitations, the court overstepped the proper scope of judicial review. Here, however, the EPA's model satisfied both considerations and contributed to public health protection as mandated by Congress, the court reasoned that it could not properly select among alternative models. It concluded that only in the rarest of cases should the judiciary overturn such a decision made by the EPA.[100] The court's reluctance to tamper with EPA expertise resulted in a favorable climate for the use and development of more sophisticated air quality models. But by opening the door to economic considerations the court invited further judicial involvement in reviewing modeling decisions.

The Sixth Circuit, in *Cincinnati Gas & Electric Co. v. EPA*,[101] a companion case to *Cleveland Electric*, reviewed an attack on the

97. *Id.* at 1163-64.

98. *Id.* at 1164.

99. *Id.*

100. *Id.* The court said: "Finally as we pointed out at the beginning of this opinion, SO_2 emissions have a direct impact upon the health and the lives of the population of Ohio—particularly its young people, its sick people, and its old people. If the RAM model did over-predict emission rates, such a conservative approach in protection of health and life was apparently contemplated by Congress. . . ." *Id.*

101. 578 F.2d 660 (6th Cir. 1978).

use of MAXT-24 (Second Maximum Twenty-Four Hour Dispersion Model with Terrain Adjustments), another widely used EPA model. The MAXT-24 model, unlike RAM which was upheld in *Cleveland Electric*, does not provide estimates of comparative contributions to total sulfur dioxide pollution from a number of sources. Instead it measures the isolated problem of single point source contributions to ambient air quality, and is thus especially useful in rural and complex terrain areas.[102] In other aspects, however, the MAXT-24 model strongly resembles RAM in that both require a solid, ascertainable data base, including such factors as established design capacity of the power plant, sulfur contents of the fuels, stack height, wind, weather and terrain.[103]

The MAXT-24 model uses six coefficients for determining plume dispersal.[104] The classes of coefficients are based upon six different weather conditions, ranging from Class A, denoting extreme ground dispersion of plumes, to minimum dispersion, or Class F.[105] Class A is a "worst case" assumption providing for the highest ambient air quality predictions.[106] Although the petitioners in *Cincinnati Gas* did not attack the general validity of MAXT-24 they did object to the Class A coefficient assumption that had been employed, and urged the substitution of the Class B coefficient.[107] The EPA argued that its best data supported the use of Class A coefficients, and until further data were available showing that its method was not accurate, it could continue the use of the chosen class of coefficients.

102. *Id.* at 661.

103. *Id.* MAXT-24 uses a Gaussian plume formula, the standard diffusion model for plumes emanating from continuous point sources, and assumes both vertical and horizontal dispersion from the pollution source. J.H. SEINFELD, AIR POLLUTION 277-80. *See also* GUIDELINES, *supra* note 14, at 19-20. This model, like RAM, was designed by the EPA as a result of industry criticism of the use of the simple rollback model. Also, both RAM and MAXT-24 led to the imposition of less restrictive individual emission limitations than those contemplated by the earlier Ohio sulfur dioxide regulations developed with the use of the simple rollback model.

104. Plume dispersal describes how the contaminants emitted through a plume disperse upon reaching the atmosphere. The Gaussian plume formula is merely a mathematical model which describes typical plume dispersion or diffusion. *See* EPA, Workbook of Atmospheric Dispersion Estimates 61-64 (1970).

105. Cinncinnati Gas & Electric Co. v. EPA, 578 F.2d 660, 661 (6th Cir. 1978).

106. *Id.*

107. *Id.* at 662-63. Petitioners specifically alleged that the Class A coefficient was fallacious in that it used a longer period of downward draught than occurred in fact, and failed to make allowance for lateral dispersal. The Class A coefficient in this case was significant because it was the determining factor in establishing the emission limitations in almost one-third of the Ohio power plants. *Id.* at 662.

In its review of the several aspects of the use of MAXT-24, the *Cincinnati Gas* court stated that the *Overton Park* test was applicable.[108] Therefore, one might have predicted that the agency's decision would have been upheld, especially in light of *Cleveland Electric*. In that case, the court confirmed its limited role in review of agency actions and recognized that in close cases the EPA can err on the side of protecting the public health, thus implementing the explicit congressional mandate delineated in the Clean Air Act. Nonetheless, the *Cincinnati Gas* court found that the use of the Class A assumption coefficient was not rational and was therefore arbitrary and capricious,[109] and paid only lip service to the principle that courts should refrain from substituting their judgment for that of the agency. However, the court did not mandate the use of the Class B coefficients, but merely remanded the issue to the EPA for further study.[110] It indicated that a new record should be developed which would either supply the missing support for the use of Class A coefficients or endorse another solution, including the possibility of the use of Class B coefficients.

The *Cincinnati Gas* petitioners also claimed that the model did not properly account for changes in terrain.[111] The EPA argued that it had made certain adjustments so that its model could mea-

108. *Id.* at 662.

109. *Id.* at 663. One of the bases for the court's finding of arbitrariness was two private studies, commissioned by the petitioners, that came up with conclusions questioning the applicability of the Class A coefficients. *Id.* at 664. The court also considered the findings of an EPA report and conference which suggested elimination of the use of the Class A coefficient and the use of the Class B coefficient for both A and B stability categories. *Id.*

110. *Id.* After an initial study by the EPA of the utilities' suggested alternatives, the EPA has concluded that their alternatives would grossly underestimate the impact of the stack emissions and is reproposing the Pasquill Gifford Class A coefficients unless the public comments submitted can demonstrate that a different model would be more accurate. 44 Fed. Reg. 7798 (1979). For another case in which the EPA, upon judicial remand, repromulgated the same rule, *see* Portland Cement Ass'n v. Ruckelshaus, 513 F.2d 506 (D.C. Cir. 1975), *cert. denied*, 423 U.S. 1025 (1975) *and* Portland Cement Ass'n v. Ruckelshaus, 486 F.2d 375 (D.C. Cir. 1973).

111. Cincinnati Gas & Electric Co. v. EPA, 578 F.2d 660, 664-66 (6th Cir. 1978). The original MAXT-24 model assumes that a pollution plume moves down-wind in a straight line from a point determined by the height of the smokestack plus plume rise. The main problem is that petitioners and the EPA reached two different conclusions from the available data. Petitioners claimed that the model, in order to be accurate, had to incorporate mathematical changes that "would reduce the receptor height by the one-half difference between the stack base and the receptor elevation and would limit the approach of the center line of the plume to 10 metres above the receptor." *Id.* at 664. The petitioners showed that several utilities had incorporated this change in EPA-approved plans.

sure dispersion in hilly terrain more accurately. It pointed out that although the model assumed terrain features to be no higher than stack height, all of the EPA validation studies showed that the model was accurately predicting the ground level concentrations observed by the monitors.[112] The EPA noted that the petitioners' requested changes had been rejected because they had not been incorporated into any validated MAXT-24 tests.

The *Cincinnati Gas* court, using the *Overton Park* text, concluded that the EPA's rejection of the petitioners' proferred model amendments was not arbitrary, capricious, or an abuse of discretion.[113] The court's return to the *Overton Park* standard of judicial review on this issue brought its opinion into line with previous holdings on modeling. The decision thus signaled the continuation of substantial judicial acceptance of the EPA's modeling decisions despite the lack of express congressional approval of modeling techniques at the time.

V. THE PREVENTION OF SIGNIFICANT DETERIORATION PROGRAM: MODELING COMES OF AGE

The growing significance of air quality models in the attempt to preserve our air quality is perhaps best illustrated in the implementation of the Prevention of Significant Deterioration (PSD) program.[114] The key elements of the PSD program are the imposition by Congress of maximum increments for sulfur dioxide and particulate emissions in the ambient air[115] and the administrative requirement that new major stationary sources apply the best available control technology to control pollutant emissions.[116]

In order to effectuate the prevention of significant deterioration programs, the EPA Administrator proposed, in 1973, several alternative regulatory programs for public comment, three of which involved air quality modeling.[117] After public comments the Admin-

112. *Id.* at 665.

113. *Id.* at 665-66.

114. The 1970 Amendments did not expressly create a program designed to prevent the deterioration of already clean air areas. For a general history of the PSD program, *see* Pendley & Morgan, *The Clean Air Act Amendments of 1977: A Selective Legislative Analysis*, 13 LAND & WATER L. REV. 747, 749-54 (1978); Note, *The Clean Air Act and the Concept of Non-Degradation, Sierra Club v. Ruckelshaus*, 2 ECOLOGY L.Q. 801 (1972).

115. 42 U.S.C.A. § 7473.

116. 40 C.F.R. § 52.21(j)(2) (1978).

117. Prevention of Significant Air Quality Deterioration, 38 Fed. Reg. 18,986 (1973). The Air Quality Increment Plan and the Emission Limitation Plan necessi-

istrator reformulated a proposed PSD program,[118] recognizing in the program's preamble the important role of modeling.[119] Although the text of the proposed rules did not refer directly to air quality modeling, proposed new source operators covered by the PSD plan were required to submit information on the source's impact on ambient concentrations of sulfur dioxide and particulates. Significantly, the proposed regulations suggested that the use of a modeling device to convert the stack emissions to ambient concentrations of sulfur dioxide and particulates would satisfy the requirement.[120] At least new source operators, therefore, might find modeling a useful tool in meeting EPA standards.

In the PSD program as finally promulgated by the Administrator, modeling was again discussed in the preamble but not in the actual rules.[121] The Administrator, however, emphasized the accuracy of diffusion models for sulfur dioxide and total suspended particulates.[122] At the same time, the omission of nitrogen oxides and hydrocarbons from the final PSD program was explained by the lack of accurate modeling techniques for determining the impact of point source emissions for those automotive pollutants.[123]

The Administrator mandated that during the period in which the federal government was implementing the PSD program, it would use two EPA publications on air quality management and modeling in making the determination of the impact of a proposed new source.[124] Public criticism of the final PSD program centered on

tated the use of extensive air quality modeling. *Id.* at 18,990-91. The Administrator explicitly noted that the third option, the Area Classification Plan, required "diffusion modeling" to function properly. *Id.* at 18,993.

118. Prevention of Significant Air Quality Deterioration, 39 Fed. Reg. 31,000 (1974).

119. *Id.* at 31,003. In the preamble to the proposed PSD regulations, the Administrator recognized that the combination of inaccurate monitoring data and the embryonic state of the art of diffusion modeling would result in some errors in predicting short-term concentrations as well as annual concentrations of total suspended particulates and sulfur oxides. The preamble stated that models could provide a "consistent" guide to investigation of the relative environmental impact of a source or several sources. *Id.*

120. *Id.* at 31,008.

121. Prevention of Significant Air Quality Deterioration, Promulgation, 39 Fed. Reg. 42,510 (1974).

122. *Id.*

123. *Id.* at 42,511. The only model available for these reactive pollutants was an areawide proportional model which required substantial background data not generally available in the nation's clean air areas. *Id.*

124. *Id.* The two publications used by the EPA were Volume 10 (Reviewing New Stationary Sources) and Volume 12 (Applying Atmospheric Simulation Models to Air

the EPA's failure to specify how its models would accurately predict the impact of new sources on ambient air concentrations, given the limits the PSD program imposed on increments in these concentrations.[125] The Administrator also gave itself and the states the option to use other "more appropriate" techniques to ascertain source impact on air quality in a particular region.[126] This ambiguous portion of the program made the final PSD program vulnerable to attack in the courts.

One such attack arose in *Sierra Club v. EPA*,[127] where several industrial petitioners[128] challenged the PSD program, alleging that it was arbitrary and unreasonable. They claimed that new source violations of ambient air quality increment standards, prohibited by the PSD regulatory scheme, could not accurately be ascertained with existing modeling technology. In response, the EPA admitted that diffusion modeling techniques could not accurately reflect actual ambient air conditions, but asserted that these models nonetheless provided a consistent and reproducible standard for comparing the relative impacts of different sources. The District of Columbia Circuit Court of Appeals, recognizing the necessity of modeling, summarily rejected petitioners' argument.[129]

Despite the judiciary's approval of the EPA Administrator's PSD program in *Sierra Club*, congressional modification of the program had already been set in motion, culminating in the 1977 amendments.[130] Moreover, controversy over the appropriate use of mod-

Quality Maintenance Areas) of U.S. EPA Guidelines for Air Quality Maintenance Planning and Analysis (1976).

125. *Id.* at 42,512. However, the EPA Administrator refused to require the states to follow any particular analysis in determining whether increment standards would be violated.

126. *Id.*

127. 540 F.2d 114 (D.C. Cir. 1976), *cert. denied*, 430 U.S. 953 (1977), *vacated and remanded, sub nom.* Montana Power Co. v. EPA, 434 U.S. 209 (1977) (remanded for further consideration in light of the passage of the 1977 Amendments).

128. The industrial petitioners involved in this suit were joined to review the EPA-promulgated PSD regulations.

129. 540 F.2d 1114, 1116-17 (D.C. Cir. 1976).

130. In 1976 Congress decided to change some of the components of the EPA-promulgated PSD system without changing the basic system. Such data components as measurement of baseline data, increments, reclassification systems, etc. were modified ultimately by the 1977 Amendments. 42 U.S.C.A. §§ 7470-7479 (West Supp. 1977).

Although the 1976 Senate bill contained no reference to the use of air quality models in the PSD program, the House bill proposed a more explicit role for air quality monitoring. S. 3,219, 94th Cong., 2d Sess. (1976) as reported in S. REP. NO. 94-717, 94th Cong., 2d Sess. 157-60 (1976) [hereinafter cited as S. REP. 94-717]; H.R. REP. 10,498, 94th Cong., 2d Sess. § 108 (1976) as reported in H.R. REP. NO. 94-1175, 94th

eling techniques continued during the congressional process of amending the Clean Air Act in 1977. The 1977 Amendments as enacted required the EPA to designate appropriate air quality models within six months of passage of the statute, but only after full public review of the efficacy of the proposed models.[131] Departures from promulgated models could be made only following the Administrator's conclusion, after notice and public hearing, that adjustments were necessary to take into account "unique terrain or meteorological characteristics" of an area.[132]

The Administrator responded to the 1977 Amendments by formulating a two-stage series of new PSD regulations.[133] In the two-stage scheme, one set of regulations provides guidance to the states and sets minimum program standards for the revision of SIP's to conform to the new PSD requirements.[134] The other set outlines the federal PSD program that operates in the absence of approved SIP provisions.[135]

Cong., 2d Sess. 356-57 (1976) [hereinafter cited as H.R. REP. 94-1175]. Furthermore, the House bill implicitly required extensive use of air quality models by anyone proposing to construct a major emitting facility. The source operator had to show that the facility would not cause or contribute to air pollution in excess of the allowable increment, a task that would require the use of models, before receiving a mandatory pre-construction PSD permit. H.R. REP. 94-1175, *supra* at 356-57. The Administrator was authorized to formulate regulations specifying minimum requirements for the air quality analysis that was to accompany PSD permit application. *Id.*

The Conference Committee Report adopted the House provisions giving the Administrator a special role in overseeing PSD program permit applications. S. 3219, 94th Cong., 2d Sess. § 123 (1976) as reported in S. REP. NO. 97-1742, 94th Cong., 2d Sess. 44-45 (1976) [hereinafter cited as S. REP. 97-1742]. The Conference Committee Report specifically noted the adoption of the House language on the air quality analysis requirement. *Id.* at 103. In addition, the Report expressly recognized the importance of air quality modeling in the PSD program by requiring the EPA to designate "with reasonable particularity" the air quality model or models to be used. S. 3219, 94th Cong., 2d Sess. § 123 as reported in H.R. REP. 94-1742, 45. Unfortunately, these 1976 Amendments were defeated and both the House and Senate returned to their pre-Conference position which omitted any direct statutory reference to the use of air quality models and the need for the EPA to promulgate regulations governing said use. *Compare* S. 252, 96th Cong., 1st Sess. § 6 (1977) *with* S. 3219, 94th Cong., 2d Sess. § 6 (1976); and *compare* H.R. 6161, 95th Cong., 1st Sess. § 108 (1977) *with* H.R. 10,498, 94th Cong., 2d Sess. § 108 (1976).

131. H.R. REP. NO. 95-564, 95th Cong., 1st Sess., 1977 [hereinafter cited as H.R. 95-564]. *Compare* 95th Cong., 1st Sess., 91 Stat. 739 *with* H.R. 6161, § 108, 95th Cong., 1st Sess. (1977).

Specific mention of modeling is made in the standardized modeling and modeling conference sections of the 1977 Amendments. *See* 42 U.S.C. §§ 7620, 7475(e)(3)(d) (1977).

132. 42 U.S.C. § 7466(e)(3) (West Supp. 1978).

133. 43 Fed. Reg. 26,380 (1978).

134. 43 Fed. Reg. 26,382-88 (1978) (amending 40 C.F.R. § 51.24).

135. 43 Fed. Reg. 26,403-10 (1978) (amending 40 C.F.R. § 52.21).

Revision of PSD programs had a profound effect on modeling, in that modeling assumed a new role in determining whether the maximum amount of pollution allowable under the PSD regulations had been exceeded. For example, some states and industrial sources tried to argue that Congress meant to include only emissions from new or modified sources in PSD revisions.[136] Under their interpretation, a state could revise its SIP to allow greater emissions from existing sources in clean air areas. The Administrator refused to accept that interpretation, however, and required that all SIP revisions relaxing emission standards must employ air quality models to determine how much of the allowable PSD increment would be consumed under the revision.[137]

A second effect of the revision of the PSD programs strengthened federal influence on the choice of air quality models. The Administrator mandated that SIP's utilize the EPA-published Guidelines on Air Quality Models (Guidelines).[138] No substitutions or modifications could be made without a period of public comment[139] and the Administrator's approval.[140] This federalization of the modeling decision marked a departure from prior EPA policy that gave states maximum latitude to submit their own models.[141]

The EPA faced three major policy issues in developing the regulations.[142] The first was the appropriate use of preliminary screening techniques to determine when full-scale modeling is required. Under its pre-1977 Amendments to the PSD program, the EPA used a two-step procedure, with a relatively simple modeling formula for initial evaluation of a new source's potential impact on the environment.[143] Sources that satisfied the initial test were not

136. 43 Fed. Reg. 26,380 (1978).

137. *Id.* at 26,380-81.

138. *Id.* at 26,386 (amending 40 C.F.R. § 57.24(m)(1)(i)).

139. *Id.* (amending 40 C.F.R. § 51.24(m)(1)(iii)).

140. *Id.* at 26,386 (1978) (amending 40 C.F.R. § 51.24(m)(1)(iv)).

141. *See* text accompanying notes 132-34 *supra*. Congress required that the EPA hold a national modeling conference within six months of passage of the 1977 Amendments and at least one every three years thereafter. 42 U.S.C. § 7620 (West Supp. 1978). The conferences are to give special attention to the role of modeling in the PSD program. *Id.* The modeling conference requires the participation of the National Academy of Sciences, interested state and local offices and representatives from other federal agencies. 42 U.S.C. § 7620(b) (West Supp. 1978).

142. Regulations governing the federal PSD program basically mirror the SIP requirements. The GUIDELINES, note 12 *supra*, provide the basis for air quality model selection, with modification or substitution allowed only after notice and an opportunity for public comment. 43 Fed. Reg. 26,407 (1978) (amending 40 C.F.R. § 52.21(m)(2)).

143. *Id.* at 26,398. The screening technique for most sources is a simple Gaussian

subjected to more vigorous full-scale model evaluation. Industry and state air pollution control agencies wanted to increase the number of sources "screened" out of full-scale review by liberalizing the standards of the preliminary test.[144] Environmentalists, on the other hand, wanted to eliminate screening altogether and subject all sources to evaluation by more complex modeling analysis.[145] The EPA chose to compromise by continuing its basic screening techniques but warning states that more complex models would be employed where initial screening shows that a proposed source would use at least one-half of the allowable increment remaining. Thus, as the allowable increment amount decreases, the level of emissions that would consume one-half of it also diminishes, and a greater number of sources would be subject to the more complex modeling requirements.[146]

The second policy issue resolved by the EPA dealt with the propensity of certain air pollutants to travel long distances in the ambient air.[147] In developing his modeling analysis, the Administrator had to define the areas to be included in air quality impact studies. The system adopted consists of three criteria for area definition. The first provides that, as a general rule, a modeling analysis need not extend more than fifty kilometers from the source.[148] The second criterion exempts from a modeling analysis an area whose predicted ambient concentrations fall below a specified minimum level.[149] The third criterion considers the source's potential impact on a Priority I area.[150] If a potentially adverse impact caused by emissions from a proposed source can be reasonably predicted, the

dispersion equation using relatively easy to ascertain data. *See* U.S. EPA, 10 Guidelines for Air Quality Maintenance Planning and Analysis: Procedures for Evaluating Air Quality Impact of New Stationary Sources 4-1 to 4-6 (1977).

144. *Id.* The EPA had allegedly used conservative figures tending to overestimate the impact of emissions on ambient air quality.

145. *Id.*

146. *Id.*

147. Dr. Svente Oden of Sweden has done extensive research on the problem of "acid rain" in Sweden, with much of the pollutant deposits emanating from sources several hundred miles away on the European Continent. S. Oden, *The Acidification of Air and Precipitation and its Consequences in the Natural Environment*, ECOLOGY COMMITTEE BULLETIN, STATE NATURAL SERVICE RESEARCH COUNCIL (1968) (translated by Consultants, Ltd).

148. 43 Fed. Reg. 26,398 (1978).

149. *Id.* The minimum analytical increments are generally based on the Class I figures although they include increments for nitrogen oxides and carbon monoxide for which there are no PSD numerical standards.

150. *Id.*

model used must include an analysis of the impact on the Priority I area regardless of its distance from the source.

Finally, the Administrator considered establishing a mechanism for resolution of disputes over applicable and acceptable modeling techniques. Several commentators urged the creation of an arbitration board.[151] The Administrator, however, rejected this suggestion because of the on-going modeling review mandated by Congress[152] or voluntarily assumed by the EPA.[153]

Thus the 1977 Amendments resulted in changing the EPA's position on air quality modeling from one allowing state flexibility to one mandating use of EPA-specified models. Federalization of model selection makes paramount the need for on-going review of the constantly changing status of air quality modeling. Although EPA resources may well be exhausted in the attempt to keep up with modeling developments, the fact remains that in the 1977 Amendments Congress explicitly recognized air quality modeling technology as an important element in formulating clean air standards.

In addition to changing the substantive rule for use of air quality models, the 1977 Amendments clarify some of the administrative and judicial review requirements[154] that had given rise to so much litigation earlier.[155] First, however, Congress had to resolve its own difficulties with these issues. The House bill originally proposed the "substantial evidence" test for review of most agency rulemaking proceedings,[156] including general rulemaking both for SIP development and for the PSD program.[157] The Senate bill, however, did not address the problem at all.[158] In conference committee discussions, the Senate acceeded to the demands of the House managers that administrative and judicial review provisions be included[159] but refused to accept the "substantial evidence"

151. *Id.* at 26,398-99.

152. 42 U.S.C.A. § 7620(b) (West Supp. 1978).

153. The Administrator announced that in addition to the mandatory triennial modeling conference, he expected the air quality modeling guidelines to undergo extensive review every 18-24 months. This review would include at least an opportunity for written public comments on the proposed guidelines. 43 Fed. Reg. 26,399 (1978).

154. H.R. 6161, 95th Cong., 1st Sess. § 305 (1977).

155. *See* text accompanying notes 14-113 *supra*.

156. H.R. REP. NO. 95-294, 95th Cong., 1st Sess. 27,318-25 (1977).

157. *Id.*

158. S. 252, 95th Cong., 1st Sess. (1977).

159. H.R. REP. NO. 95-564, 95th Cong., 1st Sess. 177-78 (1977) [hereinafter cited

test. It preferred, in accord with the prevailing view of most courts, the "arbitrary, capricious and abuse of discretion" test of *Overton Park*.[160] The statute as enacted directs the courts to apply the *Overton Park* standards.[161]

The conference committee report, however, noted that the distinction between the "substantial evidence" and the "arbitrary, capricious and abuse of discretion" tests is somewhat illusory[162] and hinted that Congress expects courts to engage in a "searching inquiry" into EPA-promulgated rules.[163] That suggestion rekindles the dilemma encountered earlier by many courts: how much deference should a court give to EPA expertise in air quality modeling? Only the future will tell.[164]

as H.R. REP. 95-564]. *Compare* Pub. L. 95-95 § 27(a), 95th Cong., 1st Sess., 91 Stat. 739 *with* H.R. 6161, 95th Cong., 1st Sess. § 108 (1977).

160. Citizens to Protect Overton Park, Inc. v. Volpe, 401 U.S. 402 (1971).

161. Pub. L. No. 95-95, 95th Cong., 1st Sess. § 305 (1977).

162. H.R. REP. 95-564, *supra* note 177, at 177-78 (1977).

163. *Id.*

164. A recent District Court case, Environmental Study & Protection v. Pac., 464 F. Supp. 143, (D. Conn. 1978), dealing with the use of an indirect source air quality model, takes a much more deferential view of the judicary's role in reviewing the EPA's modeling decision than did the Sixth Circuit in *Cincinnati Gas* or *Cleveland Electric*. In *Environmental Study*, the use of air quality models and emission factors was attacked by an environmental group seeking to revoke an indirect source permit issued by the Connecticut Dept. of Environmental Protection (DEP) to the U.S. Dept. of Transportation (DOT) for the construction of a highway. Under the Connecticut SIP all highway projects with a design capacity of more than 1000 vehicles per hour in any direction had to receive an indirect source review permit before construction was allowed. *Id.* at 1711-12. DEP, in implementing this indirect source permit system, had developed a computer model for estimating the impact on ambient air quality by indirect sources such as highways. Using emission facts and other data supplied to them by DOT, DEP concluded that there would be no violation of the carbon monoxide standard through the year 2000 but there would be a violation of the hydrocarbon standard in both 1980 and 2000 unless the highway was extended, something that had not yet been planned. *Id.* at 1712.

After the modeling analysis was completed, the DEP Commissioner issued the indirect source permit but only after conditioning the use and operation of the highway on the prevention of hydrocarbon standard violations. The petitioners in this case argued that the proposed conditions were not sufficient to prevent the hyrdocarbon and oxidant standards from being violated and in addition that the carbon monoxide projections were erroneous and that those standards too would be violated after completion of this highway segment. *Id.* at 1712-13. Petitioners also alleged that DEP's model did not include either background levels of carbon monoxide or the impact of carbon monoxide emissions from surrounding automobiles not at the designated intersection. *Id.* at 1713. The court placed a heavy burden of proof on the petitioners to show that the use of DEP's model was arbitrary. The mere fact that certain data were not included did not overcome the evidence presented by DEP that their indirect source model reflected the state-of-the-art insofar as those types of models were concerned. *Id.*

The court concluded that absent a Congressional mandate to utilize a standardized

V. SUMMARY

In 1970 Congress blazed a new path toward the national goal of upgraded air quality, delegating most of the responsibility for implementation to the states and the EPA. Those responsible for implementation required accurate air quality models that could translate individual source emission rates into ambient air quality concentrations. The importance of air quality models was heightened by emphasis on preventing significant deterioration of already clean air. The EPA has responded adequately by utilizing the best available models in making its policy decisions, and, by fostering continued research on modeling techniques, it has opened the modeling arena to public comment.

Congress, in its enactment of the 1977 Amendments, clearly indicated its approval of agency policy on air quality models. The judiciary must bear this in mind in its review of modeling issues. Although the courts have agreed that the *Overton Park* test provides the proper scope of review in EPA modeling decisions, the test has been applied inconsistently. In the future, judicial concern over the potential hardship a decision might produce should be minimized. Congress has given the states and the EPA the primary responsibility for making these "hard case" decisions under the health-protection mandate of the Clean Air Act. Management of broader policy issues is best left to Congress or the EPA. The courts should limit their scrutiny to the reasonableness of the EPA's decisionmaking process.

model or set of emission facts for indirect sources, the state has the discretion to choose among various models and emission factors in determining whether any given indirect source will violate the SIP of national standards. Since the EPA had ratified the use of the DEP model by proposing in its own guidelines that similar type models be used by other states, the court could only conclude that there had been no abuse of that discretion. *Id.* at 1713-14. (Note that if this were a case involving a PSD permit there would be a statutory requirement to utilize a recommended model and the state would shoulder the burden of proof to justify the use of a different model. 42 U.S.C. § 7475(e)(3)(D) (1978)). The court, while not stating the scope of judicial review, is apparently using the *Overton Park* test with a traditional presumption of regularity for the administrative decision. When contrasted with *Cincinnati Gas* the court here is taking a much less active role in reviewing discretionary agency decisionmaking, preferring to defer to the expertise of DEP. This may reflect a future trend.