Acid Rain, Emissions Trading and the Clean Air Act Amendments of 1989

INTRODUCTION

Emissions of sulfur dioxide and nitrogen oxides, transported in the atmosphere, undergo chemical transformation in the air and on the earth's surface, forming acidic deposition known as acid rain.[1] Acid rain, in conjunction with other air pollutants, poses a threat to streams, lakes, forests, structures and other building materials. In 1984, the Office of Technology Assessment estimated that a reduction in annual sulfur dioxide emissions of eight to ten million tons would protect all but the most sensitive aquatic resources in many areas.[2]

The Clean Air Act Amendments of 1989,[3] proposed by President Bush, call for a two phase ten million ton reduction in annual sulfur dioxide emissions from 1980 levels by the year 2001. In addition, the bill would reduce annual nitrogen oxide emissions by two million tons below projected emissions for the year 2000.[4]

Under the President's proposal, each plant would be assigned an allowance limiting the number of tons of sulfur dioxide it could emit annually equal to the average annual quantity of million British thermal units ("mmBtus") consumed in fuel during specified years, i.e. the "baseline," multiplied by the limits on emission rates imposed by Phase I[5] and II,[6] respectively.[7] Indi-

1. For a more in-depth discussion of the atmospheric processes that contribute to the formation and deposition of acid rain, *see* NATIONAL RESEARCH COUNCIL, NATIONAL ACADEMY OF SCIENCES, ACID DEPOSITION: ATMOSPHERIC PROCESSES IN EASTERN NORTH AMERICA (1983).

2. OFFICE OF TECHNOLOGY ASSESSMENT, U.S. CONGRESS, ACID RAIN AND TRANSPORTED AIR POLLUTANTS: IMPLICATIONS FOR PUBLIC POLICY 17 (1984). This report assesses the potential impacts of acidic deposition on aquatic resources, forests, crops, materials and human health.

3. S. 1490, 101st Cong., 1st Sess. (1989); H.R. 3030, 101st Cong., 1st Sess. (1989).

4. S. 1490, 101st Cong., 1st Sess., at § 501(b) (1989).

5. Phase I places a limit on sulfur dioxide emission rates of 2.5 pounds per million Btus ("lbs/mmBtus") by 1996 on 107 power plants in twenty states. *Id.* at § 504(b). This standard would also apply to existing steam electric units 100 MWe or larger with sulfur dioxide emission rates equal or greater than 2.5 lbs/mmBtus for any calendar year from the date the law is enacted until the year 2001. *Id.* at § 504(a)(2).

6. Phase II requires steam-electric generating units equal to or greater than seventy-five MWe with 1985 actual emissions of 1.2 pounds of sulfur dioxide per mmBtus or more to

vidual owners or operators would then be permitted to trade allowances among themselves, within prescribed geographic regions.[8] Theoretically, emissions trading would reduce the cost of the pollution reduction program by relying on the market to concentrate pollution reduction on sources with the lowest marginal pollution control costs.[9]

This note assesses the potential role of emissions trading in achieving a cost effective reduction in pollution emissions under the proposed Clean Air Act Amendments of 1989. Part I discusses the need for substantial reductions in emissions of sulfur dioxide and nitrogen oxides to control acid rain. Part II describes market-based approaches to pollution control under the current Clean Air Act, including the use of bubbles, offsets, netting, and banking of emission reduction credits. Part III analyzes the proposed emissions trading program as a means to attain a more economically efficient reduction in sulfur dioxide and nitrogen oxide emissions.

I. ACID RAIN AND EMISSION REDUCTIONS

A. *Acid Rain*

Precipitation is more acidic than normal over much of eastern North America. Although rainfall is naturally acidic with a pH ranging from 4.9 to 6.5, the annual average pH in parts of the eastern United States is as low as 4.2.[10] The principal sources of this increased acidity are sulfur and nitrogen oxides from the

meet a sulfur dioxide emission rate of 1.2 lbs/mmBtus by the year 2001. *Id.* at § 505(b). For units below 75 MWe or 1.20 lbs. of sulfur dioxide per mmBtus, the bill places a cap on emission rates equal to the unit's actual annual emission rate in 1985. *Id.* at § 505(c).

7. *Id.* at § 503(a). The baseline used to calculate pollution allowances depends on the year the unit entered operation. The baseline for affected units in operation prior to January 1, 1985 is equal to the average annual quantity of mmBtus consumed in fuel during 1985-1987. *Id.* at § 502(d)(1).

8. *Id.* at § 503(b).

9. *See, e.g.* Stewart, *Controlling Environmental Risks Through Economic Incentives*, 13 COLUM. J. ENVTL. L. 153 (1988); Ackerman & Stewart, *Reforming Environmental Law: The Democratic Case for Market Incentives*, 13 COLUM. J. ENVTL. L. 171 (1988).

10. NATIONAL RESEARCH COUNCIL, *supra* note 1, at 13-14. pH is a logarithmic scale, ranging from 0 to 14, used to express acidity and alkalinity. A pH value of 7.0 is neutral; pH values below 7.0 are increasingly acidic and values greater than 7.0 indicate increasing alkalinity. Because the scale is logarithmic (i.e. nonlinear) each unit represents a ten fold change. For example, as compared to a pH of 7.0, pH 6.0 is ten times more acidic and a pH of 5.0 is 100 times more acidic. OFFICE OF TECHNOLOGY ASSESSMENT, *supra* note 2, at 5.

combustion of fossil fuels. In 1985, anthropogenic sources of sulfur dioxide emissions totaled approximately twenty-seven million tons of which 15.8 million tons were emitted by electric utilities.[11]

Sulfur dioxide emitted into the earth's atmosphere is chemically transformed into sulfuric acid which falls to earth in precipitation (wet deposition). Sulfur dioxide may also be deposited on the earth's surface as dry particles and gases, where it is eventually converted to acid (dry deposition). Although the relationship between emissions and acidic deposition in both a dry and wet form is complex, the National Research Council concluded in 1983, based on empirical data, that "there is no evidence for a strong nonlinearity in the relationship between long-term average emissions and depositions in eastern North America."[12] This is important because it suggests that a program to reduce sulfur dioxide emissions will lead to essentially proportional reductions in wet sulfate deposition.

Acidic deposition impacts streams, lakes, forests, and buildings. Surface waters surrounded by slow weathering bedrock and thin soils with rapid runoff rates have little or no capacity to neutralize acids and therefore are particularly sensitive to acidic deposition. Sensitive areas include much of the northeastern United States, southeastern Canada, and northern Wisconsin and Minnesota. In the northeastern United States alone, 30 to 40 percent of the more than 5,000 lakes and 10 to 20 percent of the 65,000 stream miles are considered extremely vulnerable to acidic deposition.[13]

Although a lack of reliable historical data makes it difficult to assess the exact extent of the impact of acidic deposition on aquatic ecosystems, significant changes in water chemistry have been documented throughout the northeastern United States and southeastern Canada. Changes in pH and other water quality parameters may have an adverse impact on aquatic biota. Declines in fish populations associated with acidic deposition have been observed in the Adirondacks of New York State and the LaCloche Mountain region of Ontario.[14]

Scientists have also discovered that several tree species throughout the eastern United States, particularly conifers at

11. CONGRESSIONAL BUDGET OFFICE, U.S. CONGRESS, CURBING ACID RAIN: COST, BUDGET, AND COAL-MARKET EFFECTS, at xv (1986).

12. NATIONAL RESEARCH COUNCIL, *supra* note 1, at 139.

13. OFFICE OF TECHNOLOGY ASSESSMENT, *supra* note 2, at 81.

14. *See* Schofield, *Acid Precipitation: Effects on Fish*, 5 AMBIO 228 (1976).

higher elevations, have experienced a significant decline in growth, dating back to the early 1960's.[15] Although it is difficult to determine whether forest decline is directly attributable to acidic deposition, either acting alone or in concert with other agents (e.g. other air pollutants, climate change, insects or disease), the fact that changes in growth patterns have occurred in areas of elevated acidic deposition suggests that acid rain may be a contributing factor. Potential pathways include direct impacts on tree foliage and indirect impacts on forest soils, i.e. leaching of needed nutrients and the release of potentially toxic heavy metals.[16] Additional research is under way to document the extent of the forest decline and to identify more precisely its causative factors.

Finally, acidic deposition can damage historically important monuments as well as more common building materials such as metals, masonry, and painted surfaces. Although studies have demonstrated that a broad range of materials may be affected by sulfur oxides, quantifying the extent of the damage actually caused by sulfur oxides and its economic cost is difficult. One study estimated that repainting of surfaces damaged by sulfur dioxide in the Boston Metropolitan area alone costs as much as 31.3 million dollars annually.[17] On a national scale, costs could easily run into the hundreds of millions of dollars per year, if not higher.[18]

B. *Emission Reductions and the Costs of Control*

To address these and other environmental impacts associated with acidic deposition, recent legislative proposals to reduce sulfur dioxide emissions have called for an annual reduction of eight to twelve million tons.[19] However, a reduction program is expen-

15. Tomlinson, *Air Pollutants and Forest Decline*, 17 ENVTL. SCI. & TECH. 246A (1983).

16. Siccama, Bliss & Vogelman, *Decline of Red Spruce in the Green Mountains of Vermont*, 109 BULL. TORREY BOTANICAL CLUB 162, 166-67 (1982).

17. TRC ENVIRONMENTAL CONSULTANTS, INC., AIR POLLUTION DAMAGE TO MAN-MADE MATERIALS: PHYSICAL AND ECONOMIC ESTIMATES (Electric Power Research Institute, EPRI EA-2837, 1983).

18. *Air Pollution: Acid Rain Estimated to Cause $7 Billion in Damage to Materials Yearly in 17 States*, 16 Env't. Rep. (BNA) 504 (July 26, 1985).

19. The U.S. Senate Committee on Environment and Public Works has reported acid rain legislation requiring a reduction in sulfur dioxide emissions ranging from eight to ten to twelve million tons in 1982, 1984, and 1987, respectively. S. REP. No. 228, 101st Cong., 1st Sess. 4 (1989).

sive. A 1986 Congressional Budget Office study concluded that an eight million ton reduction could increase annual electric production costs by $1.9 to 2.1 billion by 1995.[20] A ten million ton reduction in annual emissions could increase electricity costs by $3.2 to 4.7 billion.[21] While the impact on electricity rates of a ten million ton reduction in sulfur dioxide emissions would average only two to five percent, rates in a few midwestern states could rise as much as ten percent.[22] Furthermore, if utilities reduced emissions by using low sulfur coal, employment in regions that mine high sulfur coal would suffer.[23]

The acid rain issue pits northeastern states, the recipients of acidic deposition, against states in the Midwest that emit large quantities of sulfur dioxide. To reduce the economic burden on midwestern states, one alternative is a national electricity tax -the proceeds of which would be used to establish a trust fund to pay for emission reductions. Although this approach is more difficult to administer than simply requiring sources allocated emission reductions to bear their own costs, it has the advantage of distributing the economic burden more uniformly across all fifty states.[24] Similarly, to minimize the impact of an acid rain reduction program on mine workers, legislation could encourage the use of technological controls in lieu of low sulfur coal or provide economic assistance to displaced coal workers. Each of these mitigation measures, however, would increase the cost of an acid rain reduction program.[25]

The high cost of sulfur dioxide emission controls is a potentially significant obstacle to passage of an acid rain bill. In this context, market-based approaches to pollution control that, at least in theory, offer the same level of environmental protection but at lower cost and with less economic disruption are economically and politically attractive. The next section of the note will give a historical overview of the market-based approaches to pollution control found in the current Clean Air Act. It will conclude

20. CONGRESSIONAL BUDGET OFFICE, *supra* note 11, at 7.

21. *Id.*

22. OFFICE OF TECHNOLOGY ASSESSMENT, *supra* note 2, at 14.

23. *Id.* The Office of Technology Assessment estimated that a ten million ton reduction in sulfur dioxide emissions could eliminate 20,000 to 30,000 jobs from projected 1990 levels in regions that mine high sulfur coal. Although employment would increase in low sulfur coal regions, thousands of workers would be displaced.

24. *Id.* at 140.

25. *See Id.* at 140-46.

by analyzing the extent to which each of the existing market-based approaches to air pollution control have been successful and attempt to identify factors contributing to their success (or failure) which may be relevant to the proposed emissions trading program.

II. MARKET-BASED APPROACHES TO POLLUTION CONTROL

A. *Traditional Approaches to Air Pollution Control*

The Clean Air Act requires the Administrator of the U.S. Environmental Protection Agency ("Administrator") to promulgate national ambient air quality standards ("NAAQS") for criteria pollutants to protect public health and welfare.[26] Under the Clean Air Act Amendments of 1970, the NAAQS were supposed to be met by 1975 in 247 air quality control regions ("AQRS") through state regulation of existing sources[27] as well as national emission standards for new or modified stationary sources, called new source performance standards ("NSPS").[28] In 1977, the Clean Air Act was amended.[29] In addition to extending the deadline for attainment of all primary national ambient air quality standards, the 1977 amendments established new standards for emissions from both new and existing sources in attainment[30] as well as nonattainment areas.[31]

To reduce administrative costs of regulating air pollution across a number of different and highly diverse industries, the Environmental Protection Agency ("EPA") has relied on uniform

26. Clean Air Act § 109, 42 U.S.C. § 7409 (1982). National Ambient Air Quality Standards are divided into primary and secondary standards. Primary standards are designed to protect public health whereas secondary standards protect public welfare. Criteria pollutants include sulfur oxides, particulate matter, carbon monoxide, ozone, nitrogen dioxide, hydrocarbons and lead. 36 Fed. Reg. 1502, 1515 (1971); 46 Fed. Reg. 14,921 (1976).

27. *See* Clean Air Act, §§ 109 and 110, 42 U.S.C. §§ 7409-7410 (1982). Under § 110 of the Clean Air Act, each State is required to develop and implement, subject to the Administrator's approval, State Implementation Plans ("SIP's") to achieve and maintain NAAQS.

28. *See* Clean Air Act § 111, 42 U.S.C. § 7411 (1982). The Administrator is required to establish federal standards of performance for categories of newly constructed or modified stationary sources based on the best technological controls that can be achieved, taking into account control costs, as well as health, environmental, and energy concerns.

29. For a more detailed discussion of air pollution and the 1977 Amendments of the Clean Air Act, *see* 1 F. GRAD, TREATISE ON ENVIRONMENTAL LAW ch. 2 (1989).

30. *See* Clean Air Act §§ 160-169, 42 U.S.C. §§ 7470-7479 (1982). Areas in compliance with NAAQS are referred to either as Prevention of Significant Deterioration ("PSD") areas or as attainment areas.

31. *See* Clean Air Act §§ 171-178, 42 U.S.C. §§ 7501-7508 (1982). Nonattainment areas are areas not yet in compliance with NAAQS.

standards for categories of sources. Critics of this approach to regulation contend that because uniform standards ignore individual variations in pollution control costs, firms with high pollution abatement costs are forced to achieve the same standard of pollution control as firms with significantly lower costs. As a result, pollution control programs are inherently economically inefficient.[32] In addition, critics argue that uniform standards in conjunction with a more formal rulemaking process and liberalized standing rules have led to pervasive litigation and protracted judicial review which is both time-consuming and expensive.[33] Finally, by imposing more stringent standards on new sources of pollution as well as more profitable industries, this approach deters investment and innovation.[34] Dissatisfied with the traditional command and control approach to pollution control, the EPA began to experiment with market-based approaches to pollution control in the 1970's.

B. *Development of Market-Based Approaches to Pollution Control Under the Current Clean Air Act*

Since 1977, the EPA has adopted several market-based approaches to air pollution control designed to reduce pollution control costs and to expedite compliance with the Clean Air Act. These include: (1) emission reduction banking; (2) offsets; (3) netting; and (4) bubbles. Collectively referred to as "emissions trading," these programs allow emission sources to generate emission reduction credits. The credits can then be used by other sources to comply with pollution control standards.[35]

1. Emission Reduction Banking

Under the emission reduction banking program, firms may store emission reduction credits, generated by reductions in pollution emissions below applicable limits, in EPA approved banks. Provided the credits are generated by surplus reductions that are

32. Stewart, *supra* note 9, at 156. *See also* Ackerman & Stewart, *supra* note 9, at 174-76.

33. *See* Stewart, *The Discontents of Legalism: Interest Group Relations in Administrative Regulation*, 1985 WIS. L. REV. 655, 666-68 (1985).

34. Stewart, *Economics, Environment, and the Limits of Legal Control*, 9 HARV. ENVTL. L. REV. 1, 8 (1985); *see also* Stewart, *supra* note 9, at 158.

35. EPA Final Emissions Trading Policy Statement, 51 Fed. Reg. 43,814 (1986).

permanent, enforceable and quantifiable, the credits may be used in bubbles, offsets or netting.[36]

2. Offsets

Emission offsets allow new sources to be constructed in nonattainment areas as long as new emissions are more than offset by reductions in emissions from existing sources. First proposed by the EPA in 1976[37] and subsequently incorporated into the Clean Air Act by the 1977 Amendments,[38] offsets are designed to permit some growth to occur in nonattainment areas while ensuring that air quality does not deteriorate even further.[39]

Under the current Clean Air Act, new sources or major modifications of existing sources can be constructed in nonattainment areas provided: (1) emissions are more than offset by reductions in emissions from existing sources[40] or the increased emissions will not exceed the allowance identified in the state implementation plan ("SIP"); (2) the new source complies with lowest achievable emission rate ("LAER");[41] (3) all other major stationary sources owned or controlled by the applicant within the same state are currently in compliance or on a schedule for compliance with applicable emission limits; and (4) the nonattainment area has an EPA approved SIP.[42]

3. Netting

Netting allows modifications of existing major sources in attainment and nonattainment areas to avoid new source review ("NSR") preconstruction permit requirements by applying internally generated emission reduction credits against any increases

36. *Id.* at 43,831.

37. Requirements for Preparation, Adaptation, and Submittal of Implementation Plans, 41 Fed. Reg. 55,524, 55,525 (1976) (codified as amended at 40 C.F.R. § 51 (app. S) (1989)).

38. *See* Clean Air Act § 173, 42 U.S.C. § 7503 (1982).

39. EPA Final Emissions Trading Policy Statement, *supra* note 35, at 43,830-31. The Final Emissions Trading Policy Statement also permits offsets to be used in attainment areas to allow growth that otherwise might exceed the applicable PSD increment, ambient air quality standard, or impair visibility in a Class I area.

40. The offset must make "reasonable further progress" towards attainment of the applicable NAAQS, as defined in the Clean Air Act, § 171(1), 42 U.S.C. § 7501(1) (1982).

41. The lowest achievable emission rate ("LAER") is the most stringent emission limitation found in any SIP or achieved in practice for a particular class or category of source. Clean Air Act § 171(3), 42 U.S.C. § 7501(3) (1982).

42. Clean Air Act § 173, 42 U.S.C. § 7503 (1982).

in emissions caused by the proposed modification.[43] In essence, netting treats the entire plant as if it is a single source encased in an imaginary bubble, i.e. the bubble concept. As a result, NSR preconstruction permit requirements apply only if "modifications" lead to a significant net increase[44] in plantwide emissions.

Because netting does not involve a significant net increase in plantwide emissions, proponents contend that netting encourages new investment without harming the environment.[45] Critics counter that investment decisions are not made solely on the basis of pollution control costs and that netting in nonattainment areas delays progress towards compliance with national ambient air quality standards.[46]

The bubble concept was first proposed in 1975 as a way for existing sources undergoing modifications to avoid NSPS (i.e. "net out"). In response to pressure from the nonferrous smelting industry and the Department of Commerce,[47] the EPA adopted regulations classifying an entire plant as a single "stationary source."[48] Under this definition, an individual facility could avoid NSPS as long as any increase in emissions from that facility was offset by emission reductions from other facilities within the same plant.

In *Asarco, Inc. v. EPA*,[49] however, the D.C. Circuit held that the new regulations were inconsistent with the language and purpose of the statute which defined a stationary source as "any building, structure, facility, or installation which emits or may emit any air pollutant."[50] By changing "the basic unit to which the NSPS's apply from a single building, structure, facility or installation. . .to

43. EPA Final Emissions Trading Policy Statement, *supra* note 35, at 43,830.

44. Modifications of existing major sources do not trigger NSR preconstruction permit requirements unless increases in net emissions equal or exceed specified limits for individual pollutants, i.e. are significant. *See e.g.*, 40 C.F.R. § 52.21(b)(23) (1989).

45. R. LIROFF, REFORMING AIR POLLUTION LEGISLATION: THE TOIL AND TROUBLE OF EPA'S BUBBLE 13-14 (1986).

46. *Id.*

47. *See* Asarco, Inc. v. EPA, 578 F.2d 319, 323 (D.C. Cir. 1978).

48. Standards of Performance for New Stationary Sources, 40 Fed. Reg. 58,416, 58,418 (1975) (revoked 45 Fed. Reg. 5616 (1980)). The regulation defined stationary source as "any building, structure, facility, or installation which emits or may emit any air pollutant and which contains any one or combination of the following: (1) Affected facilities. (2) Existing facilities. (3) Facilities of the type for which no standards have been promulgated in this part."

49. 578 F.2d 319 (D.C. Cir. 1978).

50. *Id.* at 326 (*quoting* the Clean Air Act, § 111(a)(3), 42 U.S.C. § 1857c-6(a)(3) (1970)).

a combination of such units,"[51] the court concluded that the EPA had violated its authority. Furthermore, the use of bubbles to net out of NSPS did not improve air quality, undermining a fundamental objective of the Act.[52]

In 1978, the EPA promulgated new PSD regulations[53] that defined "source" broadly to include "any structure, building, facility, equipment, installation or operation (or combination thereof) which is located on one or more contiguous or adjacent properties and which is owned or operated by the same person (or by persons under common control)."[54] Under this definition, modifications of individual pieces of equipment within an existing source could net out of best available control technology ("BACT") as well as preconstruction air quality impact review requirements as long as any increase in emissions attributable to the proposed modification was offset by emission reductions at the same plant.[55]

In *Alabama Power Co. v. Costle*,[56] the D.C. Circuit held that "source" could not be defined to include "equipment," "operation" or "combination thereof" because it was inconsistent with the definition of "stationary source" found in section 111(3) of the Act.[57] Nevertheless, the court concluded that for the purposes of PSD, EPA could treat an entire plant as a single "source" if EPA defined the remaining terms, i.e. "structure," "building," "facility" or "installation," broadly enough to encompass an en-

51. *Id.* at 327.

52. *Id.* at 327-29.

53. The EPA first promulgated PSD regulations in 1974 in response to Sierra Club v. Ruckelshaus, 344 F. Supp. 253 (D.D.C.) *aff'd per curiam*, 4 Env't Rep. Cas. (BNA) 1815 (D.C. Cir. 1972) *aff'd by an equally divided Court sub nom.* Fri v. Sierra Club, 412 U.S. 541 (1973). The 1974 regulations were upheld in Sierra Club v. EPA, 540 F.2d 1114 (D.C. Cir. 1976) *cert. denied*, 430 U.S. 959 (1977). *See generally* Note, *Review of EPA's Significant Deterioration Regulations: An Example of Difficulties of the Agency-Court Partnership in Environmental Law*, 61 VA. L. REV. 1115 (1975).

54. Requirements for Preparation, Adoption, and Submittal of Implementation Plans, 43 Fed. Reg. 26,380, 26,383 (1978) (amended 45 Fed. Reg. 52,676, 52,731 (1980)); *See also* Approval and Promulgation of State Implementation Plans, 43 Fed. Reg. 26,388, 26,404 (1978) (amended 45 Fed. Reg. 52,676, 52,736 (1980)).

55. Approval and Promulgation of State Implementation Plans, *supra* note 54, at 26,406-07 (1978) (amended 45 Fed. Reg. 52,676, 52,740 (1980)). If potential emissions from a proposed modification exceeded specified limits the modification was considered major. A "major modification" could not avoid BACT requirements by offsetting emission increases with emission reductions at the same source. *Id.*

56. 636 F.2d 323 (D.C. Cir. 1979).

57. *Id.* at 395-96.

tire plant.[58] Since "modifications" subject to PSD review requirements were limited to changes in a "source" that produced a net increase in total emissions,[59] this new definition would allow existing sources in attainment areas to avoid PSD new source review requirements as long as there was no net increase in plantwide emissions.[60]

In 1980, in response to *Alabama Power Co. v. Costle*,[61] the EPA promulgated regulations that defined stationary source as an entire plant by defining "building, structure, facility or installation" as "all of the pollutant-emitting activities which belong to the same industrial grouping, are located on one or more contiguous or adjacent properties, and are under the control of the same person (or persons under common control). . . ."[62] Major stationary sources in attainment areas could now net out of PSD new source review requirements provided modifications did not lead to a "significant net increase" in plantwide emissions.[63]

In nonattainment areas, the EPA initially defined "source" as both an entire plant and an individual piece of equipment at a plant.[64] Under this "dual definition," netting opportunities in nonattainment areas were limited because emission increases had to be offset by emission reductions from the same piece of equipment. But in 1981, the EPA reversed direction, adopting a definition of "stationary source" identical to the one used in attainment areas since 1980.[65] As a result, applicants in states that revised their SIP's to incorporate the EPA's new definition could net out of NSR preconstruction permit requirements in both attainment and nonattainment areas.

58. *Id.* at 396-98.

59. *Id.* at 400-01.

60. Note, *The EPA's Bubble Concept After Alabama Power*, 32 STAN. L. REV. 943, 957-58 (1980).

61. 636 F.2d 323 (D.C. Cir. 1979).

62. Requirements for Preparation, Adoption, and Submittal of Implementation Plans; Approval and Promulgation of Implementation Plans, 45 Fed. Reg. 52,676, 52,680, 52,731, 52,736 (1980) (codified at 40 C.F.R. § 51.166(b)(6) (1989); 40 C.F.R. § 52.21(b)(6) (1989)).

63. *Id.* at 52,677.

64. *Id.* at 52,680 (1980) (modified 46 Fed. Reg. 50,766 (1981)).

65. Requirements for Preparation, Adoption, and Submittal of Implementation Plans and Approval and Promulgation of Implementation Plans, 46 Fed. Reg. 50,766 (1981) (codified at 40 C.F.R. § 51.165(a) (1989); 40 C.F.R. § 51 (app. S) (1989); 40 C.F.R. § 52.24(f) (1989)).

The new definition was promptly challenged by the Natural Resources Defense Council as well as other environmental groups. In *Natural Resources Defense Council v. Gorsuch*,[66] the court of appeals held that the plantwide definition of "stationary source" was invalid, at least as it applied to nonattainment areas. The court reasoned that defining "source" as an entire plant delayed compliance with applicable NAAQS and therefore was inconsistent with the nonattainment provisions of the Act.[67]

In 1984, the judgment of the court of appeals was reversed by the Supreme Court in *Chevron U.S.A. v. Natural Resources Defense Council*.[68] The Court concluded that in the absence of statutory language clearly defining "source" as used in this context and persuasive legislative history, the EPA had adopted a "permissible construction of the statute which seeks to accommodate progress in reducing air pollution with economic growth."[69] The Supreme Court's decision in *Chevron* cleared the way for modifications of existing sources in both attainment and nonattainment areas to net out of NSR preconstruction permit requirements as long as plantwide emissions did not significantly increase.[70]

4. Bubbles

Bubbles, in their current form, allow existing plants to increase emissions at one or more emission points provided any increases are offset by comparable emission reductions from other emission points within the so-called bubble.[71] Since a bubble may encompass one or more plants, this gives existing sources greater flexibility to rearrange emissions to minimize pollution control costs while still meeting applicable SIP control requirements.

66. 685 F.2d 718 (D.C. Cir. 1982) *rev'd sub nom.* Chevron U.S.A. v. Natural Resources Defense Council, 467 U.S. 837 (1984).

67. *Id.* at 720.

68. 467 U.S. 837 (1984).

69. *Id.* at 866.

70. EPA Final Emissions Trading Policy Statement, *supra* note 35, at 43,816, 43,830 (1986). In response to Chevron U.S.A. v. Natural Resources Defense Council, 467 U.S. 837 (1984), S. 1630 would eliminate netting in nonattainment areas by redefining major stationary source as "each discrete operation, unit, or other activity and each combination thereof". S. 1630, 101st Cong., 1st Sess., § 106(b)(5) (1989). *See also* S. REP. No. 228, *supra* note 19, at 23-25 (1989).

71. EPA Final Emissions Trading Policy Statement, *supra* note 35, at 43,830. Although Asarco, Inc. v. EPA struck down the use of bubbles by existing sources as a means to avoid New Source Performance Standards, it did not preclude the use of bubbles by existing sources to comply with SIP requirements. *See supra* text accompanying notes 49-52.

In December of 1979, the EPA finalized a new bubble policy that allowed existing sources currently in compliance with applicable SIP requirements in both attainment and nonattainment areas to use bubbles to comply with SIP requirements, subject to certain restrictions.[72] In 1981, the EPA approved the use of a generic bubble by the State of New Jersey that eliminated the need to treat each trade as an SIP revision.[73] The use of bubbles, as well as other emissions trading programs, are now governed by comprehensive EPA guidelines.[74]

5. EPA Oversight of Emissions Trading Programs

In April 1982, the EPA published an emissions trading policy that encompassed bubbles, netting, offsets, and emission reduction banking. The new emissions trading policy made it easier to engage in emissions trading and expanded opportunities for firms to use bubbles.[75] A Final Policy Statement on Emissions Trading, issued in 1986, established new guidelines to be used by the EPA in evaluating future emissions trades.[76] It included more stringent restrictions on the creation and use of emission reduction credits as well as the use of bubbles in nonattainment areas.

C. *Current Status of Emissions Trading Programs*

1. Cost Savings

As of 1985, the EPA had approved forty-two bubbles and the states had approved ninety.[77] In addition, there had been ap-

72. Recommendation for Alternative Emission Reduction Options Within State Implementation Plans, 44 Fed. Reg. 71,780 (1979). Under the regulations a bubble could not be used to comply with an SIP unless: (1) it did not jeopardize reasonable further progress towards compliance with ambient air quality standards by sources in nonattainment areas; (2) emission limitations and compliance schedules were in effect for all emission points involved in the alternative approach; (3) it involved even trades of comparable pollutants; and (4) the alternative control strategy was enforceable and would not delay compliance with the SIP. *See* Comment, *Economic Efficiency in Pollution Control: EPA Issues "Bubble" Policy for Existing Sources Under the Clean Air Act*, 10 Envtl. L. Rep. (Envtl. L. Inst.) 10,014, 10,016-17 (Jan. 1980).

73. Approval and Promulgation of State Implementation Plans; State of New Jersey, 46 Fed. Reg. 20,551, 20,552 (1981) (codified as amended at 40 C.F.R. § 52.1582(a) (1989)).

74. *See* EPA Final Emissions Trading Policy Statement, *supra* note 35.

75. EPA Emissions Trading Policy Statement, 47 Fed. Reg. 15,076 (1982).

76. EPA Final Emissions Trading Policy Statement, *supra* note 35.

77. Hahn & Hester, *The Market for Bads: EPA's Experience with Emissions Trading*, 11 REG. 48, 51 (1987).

proximately 2,000 offsets and 8,000 netting transactions.[78] The principal advantage of emissions trading is that it reduces pollution control costs by giving both new and existing sources greater flexibility in meeting applicable performance standards. In 1985, the EPA concluded that bubbles already approved or pending approval by EPA had saved an estimated $300 million. If bubbles that had been proposed, developed, or approved by individual states were included, total savings could exceed $800 million.[79] In 1987, Hahn and Hester calculated that netting transactions had saved approximately $4 billion.[80]

Although these cost savings are significant, emissions trading has at times frustrated efforts to improve air quality. Specifically, in some cases sources have "bubbled into compliance"[81] by using paper reductions to offset actual emissions that otherwise would exceed applicable standards. In addition, netting has allowed existing sources to avoid new source review requirements.

2. Legal and Economic Barriers to Implementation

Although emissions trading programs, as compared to more conventional pollution control methods, have resulted in considerable cost-savings, emissions trading has also encountered significant political and legal obstacles.[82] Initially, much of the debate focused on regulations defining key statutory terms such as "stationary source" which allowed firms to meet applicable standards by aggregating emissions from individual point sources. More recently, critics have questioned whether emission inventories found in SIP's as well as underlying assumptions regarding the relationship between emissions and air quality are adequate to ensure that the proposed trades are in fact equivalent, i.e. involve not only equal amounts of the same pollutants but will not result in a deterioration in ambient air quality at one or more receptor sites.[83]

One issue widely debated was whether the baseline for determining emission credits should be defined in terms of allowable

78. *Id.* at 50.

79. LIROFF, *supra* note 45, at 62 (*citing* REGULATORY REFORM STAFF, U.S. ENVIRONMENTAL PROTECTION AGENCY, EMISSIONS TRADING STATUS REPORT (1985)).

80. Hahn & Hester, *supra* note 77, at 50.

81. LIROFF, *supra* note 45, at 100.

82. *See generally* B. COOK, BUREAUCRATIC POLITICS AND REGULATORY REFORM (1988).

83. *See* Levin, *Statutes and Stopping Points: Building a Better Bubble at EPA*, 9 REG. 33, 35 (1985); Hahn & Hester, *supra* note 77, at 49.

or actual emissions. If applicants use allowable emissions as their baseline, firms could obtain emission credits for the difference between their allowable limit and actual emissions. These credits could then be used by other sources, resulting in a net increase in actual emissions, even though on paper no increase has occurred. For this reason, it is referred to as "paper trading."[84]

The 1986 Final Emissions Trading Policy Statement addressed these and other issues by tightening trading rules.[85] Although restrictions on trading are designed to prevent abuses, they also lead to increased uncertainty and higher transaction costs for participants. In the face of uncertainty regarding the future of emissions trading, prospective sellers may decide to hold onto their credits for internal use. As a result, under more stringent trading rules, buyers may not only have a more difficult time establishing that the proposed trade is fair but also may not be able to locate a firm with excess emissions willing to sell their emission credits.[86]

Given the uncertainty surrounding emissions trading and the relatively high transaction costs, it is perhaps not surprising that the vast majority of trades to date have been intra-firm transactions, often involving the same facility.[87] Although intra-firm transactions lower transaction costs and reduce risks for the prospective seller, a limited market for emission reduction credits also means a less economically efficient system.

3. Administration and Enforcement

Regardless of whether the trade is an internal or external one, government oversight of emissions trading is critical because

84. Dudek & Palmisano, *Emissions Trading: Why is this Thoroughbred Hobbled?*, 13 COLUM. J. ENVTL. L. 217, 239-40 (1988).

85. EPA Final Emissions Trading Policy Statement, *supra* note 35, at 43,832. The 1986 Emissions Trading Policy Statement requires that baseline emissions in attainment areas be determined using the lower of actual or allowable emissions and in nonattainment areas that the baseline used to determine credits be consistent with the method used in the SIP to demonstrate attainment. In addition, proposed trades must satisfy stringent tests designed to protect ambient air quality. *Id.* at 43,827-29, 43,833, 43,843-45.

86. *See* U.S. GENERAL ACCOUNTING OFFICE, A MARKET APPROACH TO AIR POLLUTION CONTROL COULD REDUCE COMPLIANCE COSTS WITHOUT JEOPARDIZING CLEAN AIR GOALS 15-16 (PAD-82-15A 1982) (discusses the role of transaction costs in the development of a market for air pollution entitlements).

87. ROBERTS, *Some Problems of Implementing Marketable Pollution Rights Schemes: The Case of the Clean Air Act* in REFORM OF ENVIRONMENTAL REGULATION 93, 98 (W. Magat ed. 1982). As of 1981, Roberts estimated that 1,000 offset transactions had taken place but only thirty-five were inter-firm trades, most of which involved offsets that were donated by the seller.

both the seller and the buyer have an incentive to exaggerate the number of emission reduction credits involved in the transaction.[88] But emissions trading programs, involving multiple trades among private parties, may be difficult to administer and enforce.[89] As a result, the costs of administering a potentially complex system to verify and keep track of individual trades may be substantial relative to uniform standards.[90] On the other hand, it is arguable that any additional administrative costs are more than offset by potential savings.[91] Although at present, administration and enforcement do not appear to pose a major problem, the current emissions trading program is limited in scope and sharply constrained by the existing regulatory framework. A full-scale emissions trading program with fewer regulatory restrictions, like that proposed by President Bush as part of the Clean Air Act Amendments of 1989, may be significantly more difficult to monitor and enforce.

4. Effectiveness of Existing Emissions Trading Programs

The current emissions trading programs have resulted in significant cost savings, as compared to more conventional methods. Admittedly, in some cases, the added flexibility has allowed firms to delay compliance with more stringent technology forcing standards. But emissions trading programs have also given many firms the opportunity to rearrange conventional pollution controls in a more cost effective manner, with little or no environmental impact.[92]

The market for emission reduction credits, however, has been hampered by regulatory restrictions as well as the natural reluctance of private parties to engage in a relatively new approach to pollution control. Although these restrictions help ensure that cost savings attributable to emissions trading do not come at the expense of environmental objectives, they also reduce the pro-

88. *Id.* at 102.

89. Levin, *supra* note 83, at 36.

90. *See* Landau, *Economic Dream or Environmental Nightmare? The Legality of the "Bubble Concept" in Air and Water Pollution Control*, 8 B.C. ENVTL. AFF. L. REV. 741, 778-79 (1980).

91. *Id.* at 779.

92. Dudek & Palmisano, *supra* note 84, at 233-34 (estimating that emissions trading has saved more than five hundred million dollars with little or no adverse effect on air quality objectives).

gram's economic efficiency.[93] Economic efficiency could be enhanced through a more active market. But as long as credits are limited to reductions above and beyond already tough pollution control standards and trades must satisfy stringent tests designed to protect ambient air quality, intra-firm permit transactions are likely to remain the norm.

III. Emissions Trading and the Clear Air Act Amendments of 1989

A. *Emissions Trading*

An alternative to direct controls on individual sources dictating not only the amount of pollution that can be emitted but the type of controls necessary to achieve the desired level of pollution reduction is a market-based approach. In theory, a market-based approach would achieve the same level of environmental protection but in a more economically efficient manner by relying on the market to allocate pollution control to existing sources with the lowest pollution abatement costs.[94]

A market-based approach could be implemented through a tax on pollution emissions or through a full-scale system of freely tradeable pollution permits that are issued or auctioned to existing sources.[95] A tax on emissions would provide an economic incentive to polluters to reduce their emissions up to the amount of the tax. Similarly, an emissions trading program would give firms with relatively low pollution abatement costs an economic incentive to reduce pollution and to either hold onto their excess allowances for future expansion or to sell them to firms with higher pollution abatement costs.[96] In comparison to the current system of controlled trading within a system of rigid rules and regulations, a true market-based approach would allow all sources

93. *See* Raufer & Feldman, *Emissions Trading and What It May Mean for Acid Deposition Control*, Pub. Util. Fort., August 16, 1984; *see also* U.S. General Accounting Office, *supra* note 86, at v-vii.

94. *E.g.* Levin, *Getting There: Implementing the Bubble Policy*, in Social Regulation: Strategies for Reform 59, 61 (1982).

95. *E.g.* L. Lave & G. Omenn, Clearing the Air: Reforming the Clean Air Act 28-29 (1981).

96. *See generally* Stewart, *Economics, Environment, and the Limits of Legal Control*, 9 Harv. Envtl. L. Rev. 1, 9-13 (1985).

to participate and would not limit trades to emission reductions in excess of applicable standards.[97]

Regardless of the exact method employed, proponents of market-based approaches contend that it will not only lead to a more economically efficient result but that it will stimulate technological innovation since firms stand to benefit economically from more efficient pollution controls.[98] Other potential benefits include greater flexibility for individual firms to determine the optimum pollution control strategy and less regulation since the system relies largely on market transactions, rather than a complex system of bureaucratic and legal controls, to set limits on emissions from individual pollution sources.[99]

Although market-based approaches to pollution control have been praised for being economically more efficient than uniform standards, they are not without their critics. Opponents argue that experience with market-based approaches is too limited to determine whether theoretical cost savings will in fact be realized. Furthermore, monitoring and enforcement of permits may be more difficult than under a system of uniform standards, thereby increasing costs and imposing additional demands on agencies and their staffs.[100] Although there is always a risk that inadequate enforcement will undermine environmental objectives, the risk is arguably greater with an emissions trading program because emission levels at each plant will be determined primarily through private market mechanisms. Finally, there is concern in some quarters that privatization of pollution rights will make it virtually impossible to adopt more stringent standards in the future.[101]

97. Tietenberg, *Transferable Discharge Permits and the Control of Stationary Source Air Pollution: A Survey and Synthesis*, 56 LAND ECON. 391, 393 (1980).

98. *See, e.g.* LEVIN, *supra* note 94, at 59-62.

99. For a discussion of the potential benefits of market-based approaches to air pollution control *see, e.g.* Stewart, *supra* note 9, at 158-62; Stewart, *supra* note 96, at 9-13; COOK, *supra* note 82, at 25-27; Ackerman & Stewart, *Reforming Environmental Law*, 37 STAN. L. REV. 1333, 1341-46 (1985).

100. *See* Latin, *Ideal Versus Real Regulatory Efficiency: Implementation of Uniform Standards and "Fine-Tuning" Regulatory Reforms*, 37 STAN. L. REV. 1267 (1985); LAVE & OMENN, *supra* note 95, at 29.

101. Meidinger, *On Explaining the Development of "Emissions Trading" in U.S. Air Pollution Regulation*, 7 LAW & POL'Y. 447, 461 (1985).

B. *Clean Air Act Amendments of 1989*

The Clean Air Act Amendments of 1989,[102] proposed by President Bush, call for a ten million ton reduction in annual sulfur dioxide emissions from 1980 levels by the year 2001. In addition, it would reduce annual nitrogen oxide emissions by two million tons from projected emissions in the year 2000.

The reduction in sulfur dioxide emissions would occur in two phases. Phase I would limit sulfur dioxide emission rates to 2.5 lbs/mmBtus from 107 electric power plants in a total of twenty states by 1996.[103] Phase II would require steam electric units of 75 MWe or greater with sulfur dioxide emission rates of 1.2 lbs/mmBtus or more to limit emission rates by the year 2000 to 1.2 lbs/mmBtus.[104] Each plant would be assigned an allowance limiting the number of tons of sulfur dioxide it could emit annually equal to the average annual quantity of mmBtus consumed in fuel during specified years, i.e. the "baseline," multiplied by the limit on emission rates imposed by Phase I and II, respectively.[105] Permits allocating allowances to individual sources would be is-

102. S. 1490, 101st Cong., 1st Sess. (1989); H.R. 3030, 101st Cong., 1st Sess. (1989). The U.S. Senate Committee on Environment and Public Works has drafted and reported its own version of the proposed Clean Air Act Amendments of 1989 which incorporates many of the elements of President Bush's acid rain reduction program. *See* S. 1630, 101st Cong., 1st Sess. (1989). S.1630 also calls for a two phase ten million ton reduction in sulfur dioxide emissions from 1980 levels but reductions in annual nitrogen oxide emissions would total 2.7 million tons, as opposed to 2.0 million tons under the President's proposal. S. 1630 would achieve these reductions in the year 2000, one year earlier than S. 1490. As of this writing, the Senate was engaged in closed door negotiations to address the differences between the President's proposal and S. 1630.

103. Under the President's bill, this standard would also apply to steam electric units 100 MWe or larger whose sulfur dioxide emission rates equal or exceed 2.5 lbs/mmBtus for any calendar year from the date the bill is enacted up to, but not including, the year 2001. S. 1490, *supra* note 3, at § 504(a)(2). S. 1630 limits Phase I reductions in sulfur dioxide emissions to the 107 plants identified in S. 1490. S. 1630, *supra* note 102, at § 404.

104. S. 1490, *supra* note 3, at § 505(b). S. 1490 also places a cap on emission rates from units less than 75 MWe in size or with sulfur dioxide emission rates below 1.2 lbs/mmBtus equal to their actual 1985 emission rates. *Id.* at § 505(c). S. 1630 also establishes a limit on sulfur dioxide emission rates of 1.2 lbs/mmBtus from steam electric units equal to or greater than 75 MWe with 1985 emission rates of 1.2 lbs/mmBtus or more and places a cap on emission rates on units below 75 MWe and above 1.2 lbs/mmBtus equal to its actual 1985 emission rate. But S. 1630 allows units with emission rates below 1.2 lbs/mmBtus to increase emissions by as much as 20% above current levels. S. 1630, *supra* note 102, at § 405. *See also* S. REP. No. 228, *supra* note 19, at 328 (1989).

105. S. 1490, *supra* note 3, at § 503(a). S. 1630 would require the Administrator to deposit two percent of allowances for affected units in a reserve fund for future sale to new units. S. 1630, *supra* note 102, at §§ 403(a)(2)(A) and (B).

sued by the Administrator in Phase I and by States with approved permit programs during Phase II.[106]

To reduce the total cost of the pollution reduction program, the bill allows individual owners or operators to trade allowances among themselves within prescribed geographic regions. During Phase I, allowance transfers would be confined to one state with the exception of two or more sources belonging to the same owner or operator who, subject to certain restrictions, could transfer allowances among those sources. In Phase II, the country would be divided into two geographic regions and trades would be permitted within each region, as prescribed by regulation.[107]

To keep track of trades, the Administrator is required to establish a system for issuing, recording and tracking allowances.[108] Any owner or operator who exceeds their allowance would have to pay $2,000 for each ton of pollutant emitted in excess of their allowance. Excess emissions would also have to be offset by equivalent reductions in emissions during the following calendar year.[109]

The bill also calls for the Administrator to set emission rates on nitrogen oxides for coal-fired steam-electric units with a capacity of 75 MWe or greater to achieve a two million ton reduction from projected emission levels in the year 2000.[110] Although the two million ton reduction would not take effect until the year 2000, earlier reductions in nitrogen oxide emissions could be banked to be credited against reductions of sulfur dioxide or nitrogen oxide emissions required during Phase II. Interpollutant trades would be credited at the rate of 1.5 pounds of nitrogen oxide to 1.0 pounds of sulfur dioxide.[111]

106. S. 1490, *supra* note 3, at § 507; S. 1630, *supra* note 102, at § 408.

107. S. 1490, *supra* note 3, at § 503(b). S. 1630 does not restrict trades during Phase I to individual States but instead allows trading within two geographic regions in both Phases of the proposed emissions reduction program. S. 1630, *supra* note 102, at § 403(b).

108. S. 1490, *supra* note 3, at § 503(d); S. 1630, *supra* note 102, at § 403(d).

109. S. 1490, *supra* note 3, at §§ 510(a) and (b). To help detect violations, the bill requires affected sources to install continuous emissions monitors to measure sulfur dioxide and nitrogen oxide emissions. *Id.* at § 511(a). *See also* S. 1630, *supra* note 102, at §§ 411(a) and (b); § 412(a).

110. S. 1490, *supra* note 3, at §§ 506(a) and (b); S. 1630 would reduce nitrogen oxide emissions by 2.7 million tons below projected emissions in the year 2000. S. REP. No. 228, *supra* note 19, at 302.

111. S. 1490, *supra* note 3, at § 503(c); S. 1630, *supra* note 102, at § 403(c).

After December 31, 2000, new units, not eligible for an automatic allowance, will be forced to purchase allowances equal to their annual sulfur dioxide emissions.[112] These purchases ensure that the cap on emissions imposed by the bill is not circumvented by new sources.

C. *Implementing Tradeable Discharge Permits*

The government's role in establishing and administering a system of tradeable discharge permits is limited to four essential tasks.[113] First, the government must promulgate ambient air quality standards sufficient to protect human health and welfare. These standards can then be used to set limits on total emissions within prescribed geographic areas. Second, permits must be allocated to existing or new sources for emission levels up to, but not exceeding, the limit on total emissions for that geographic area. Third, to facilitate trading of those permits, a market must be established. Finally, the transfer of permits among private parties must be monitored and emission levels enforced to ensure that individual polluters do not exceed their emissions allowance. Each of these steps raise potentially significant issues. The remainder of this section will identify and analyze those issues as they relate to the proposed Clean Air Act Amendments of 1989.

1. Ambient Air Quality and Emission Reductions

Scientific studies suggest that when wet sulfate deposition is below 18 kg/hectare per year, all but the most sensitive watersheds are protected from acidification. In 1980, wet sulfate deposition was less than 40 kg/hectare per year throughout much of eastern North America.[114] Assuming that a decrease in sulfur dioxide emissions will lead to a proportional reduction in wet sulfate deposition, a fifty percent decrease in emissions across the eastern

112. S. 1490, *supra* note 3, at § 503(e). S. 1630 requires new units to obtain sulfur dioxide allowances by January 1, 2000. S. 1630, *supra* note 102, at § 403(e). New units would be free to purchase excess allowances from any existing source, irrespective of geographic location. A national market for excess allowances should help facilitate trades between existing and new sources.

113. *See* HAHN & NOLL, *Designing a Market for Tradeable Emissions Permits* in REFORM OF ENVIRONMENTAL REGULATION 120 (W. Magat ed. 1982); *see also* Ackerman & Stewart, *supra* note 9, at 184.

114. ENVIRONMENTAL DEFENSE FUND, REDUCING ACID RAIN: THE SCIENTIFIC BASIS FOR AN ACID RAIN CONTROL POLICY 4, 13 (1984).

United States should therefore protect all but the most sensitive watersheds.[115]

The proposed Clean Air Act Amendments of 1989 call for a reduction of ten million tons in annual sulfur dioxide emissions from 1980 levels. Although this represents less than a fifty percent decrease in sulfur dioxide emissions nationwide, the proposed reductions are heavily concentrated in the Midwest and the South and therefore should provide adequate protection to many surface waters in the eastern United States that are currently receiving acidic deposition.[116]

2. Allocation of Permits

a. Permit Systems The impact of emissions on ambient air quality at a given site depends not only on the quantity of those emissions but their location with respect to the receiving area. Consequently, emissions of the same pollutant but from two different locations do not necessarily have the same impact on air quality at individual receptor sites. Permit systems must therefore ensure not only that the proposed trades involve equal amounts of the same pollutant but that impacts on each and every receptor site are essentially the same, irrespective of the geographic location of its source. One alternative is to create a system of separate permits for each receptor site and then require sources to have sufficient permits to cover ambient concentrations at those sites. An ambient permit system, however, is difficult to administer since it relies on multiple permits for individual sources.[117]

Another option is to limit trading to defined geographic zones but within that zone to allow trades on a 1:1 basis on the assumption that impacts on ambient air quality of emissions of the same pollutant within that zone are, for all practical purposes, equivalent. Although an emissions based system is easier to administer than one based on ambient air quality at individual re-

115. *See Id.* at 4-5. The report recommends a 50 percent reduction in 1980 sulfur dioxide emissions from 31 States across the eastern United States, or approximately 11 million tons annually. *Id.* at 14. To protect sensitive areas the highest reductions should occur in States with the largest emissions. *Id.* at 18.

116. For a breakdown of projected sulfur dioxide emission reductions by state, *see* ICF Resources Inc., Economic Analysis of Title V (Acid Rain Provisions) of the Administration's Clean Air Act Amendments (H.R. 3030/S. 1490), attachments A and B (prepared for the EPA, September 1989).

117. Tietenberg, *supra* note 97, at 405.

ceptor sites, as the number of zones is increased the market for permits shrinks and economic efficiency suffers.[118]

A third option is to adopt rules governing individual transactions which require participating firms to demonstrate that proposed trades will not degrade air quality. The existing emissions trading programs utilize this approach.[119] The advantage is that by eliminating zones, it promotes trading across a wide geographic area while ensuring that trades maintain air quality. The primary disadvantage of this approach is that the use of mathematical models and other techniques to demonstrate that individual trades will not harm the environment increases transaction costs which may limit inter-firm trading.

The Clean Air Act Amendments of 1989 proposed by President Bush would allow trading of sulfur dioxide allowances within individual states during Phase I and in two geographic regions of the country, as prescribed by regulation, during Phase II. Because the proposed plan relies primarily on the initial spatial distribution of allowances and subsequent limits on trading within defined geographical areas to achieve the desired environmental objectives, it is essentially a zonal system. Like other emission based systems, trades involving the same pollutant in equal amounts within those zones would be allowed on a 1:1 basis.

Although trading over a fairly wide geographic area, largely unconstrained by trading rules, could result in higher concentrations of acidic deposition in some areas than others, there are several factors which may act as constraints on the creation of "hot spots." First, sulfur dioxide emission reductions are heavily concentrated in the Midwest and South so trading would, to some extent, be limited geographically by the initial distribution of allowances. Second, only emission reductions in excess of already stringent standards are transferrable to other sources. This constraint would not preclude individual sources from increasing their emissions by purchasing emission credits. But if fewer credits are available and therefore demand for credits is high, there is less chance that individual sources will be able to significantly increase their own emissions at the expense of other firms. Finally, long-range transport and mixing of sulfur dioxide in the earth's

118. *See* Krupnick, Oates & Van De Verg, *On Marketable Air-Pollution Permits: The Case for a System of Pollution Offsets*, 10 J. ENVTL. ECON. & MGMT. 233, 237 (1983).

119. *See* Hahn, *Trade-Offs in Designing Markets with Multiple Objectives*, 13 J. ENVTL. ECON. & MGMT. 1, 6-10 (1986).

atmosphere will help ensure that emissions trading does not result in a disproportionate impact on ambient air quality at individual receptor sites.[120]

b. Methods of Allocating Permits Various methods exist for the allocation of permits. For example, permits can be auctioned or distributed free of charge to existing polluters. The primary advantage of an auction is that it generates revenues for the government and by forcing each source to bid for and acquire pollution allowances it reduces the likelihood that a single firm will be able to exercise control over the market.[121] On the other hand, auctions are unpopular because they cost firms money. Free initial distribution of permits avoids auction costs; and in conjunction with trading, free distribution will provide incentives for an economically efficient system of pollution control.[122]

The proposed Clean Air Act Amendments have adopted the latter approach, distributing allowances to existing polluters at no charge.[123] The expectation is that trading will result in a reallocation of those permits to take advantage of potential cost savings.

One potential drawback of allocating allowances based on current emissions, however, is that utilities with historically high emissions that receive large allowances may be able to dominate the trading market, to the potential detriment of other existing or new sources.[124] Unlike existing sources, new units are not entitled to free allowances and therefore may be particularly sensitive to control of the market by one or even several utilities. To prevent new units from being locked out of the market, the Senate version of the bill calls for the Administrator to set aside two percent of the allowances for each existing source.[125] These reserves

120. *See* NATIONAL RESEARCH COUNCIL, *supra* note 1, at 140 (concluding that "the spatial distribution of the annual average molar ratios of pollutants in emissions and deposition suggest that atmospheric processes in eastern North America lead to a thorough mixing of pollutants over a wide geographic area, making it difficult to distinguish between the effects of distant and local sources").

121. HAHN & NOLL, *supra* note 113, at 141.

122. Lyon, *Auctions and Alternative Procedures for Allocating Pollution Rights*, 58 LAND ECON. 16, 31 (1982).

123. S. 1490, *supra* note 3, at § 503(a).

124. HAHN & NOLL, *supra* note 113, at 139-40.

125. S. 1630, *supra* note 102, at § 403(a)(2)(A). The National Clean Air Coalition has recently proposed that the reserve allowances held by EPA be increased to five percent. *Clean Air Act Amendments of 1989: Hearings on S. 1630 Before the Committee on Energy and Natural Resources*, 101st Cong., 1st Sess. (January 24, 1990) (statement of Richard E. Ayres, Chairman, National Clean Air Coalition).

could then be sold to new units that are unable to secure allowances from existing owners or operators.[126] Although the EPA has estimated that "the reservoir of potential offsets. . .will be more than ample,"[127] a reserve will help ensure that new units can enter the market thereby promoting competition and more efficient generation of electrical power.[128]

3. Establishing a Market

A fundamental assumption critical to the economic success of an emissions trading program is that permits will be freely traded among affected sources in a competitive market. Emissions trading programs under the current Clean Air Act have been hindered by restrictions on trading, high transaction costs and uncertainty over the future of these programs.

The proposed Clean Air Act Amendments place a cap on emissions, forcing new units to purchase allowances from existing dischargers. Although the cap on emissions has been criticized on the grounds that it may inhibit trading by giving existing sources an incentive to retain excess allowances,[129] a cap on emissions ensures that realized reductions are permanent. Furthermore, a limit on the number of available allowances is essential to the development of a market.[130]

The broad geographic extent of the market and the fact that trades can be made on a 1:1 basis with relatively few restrictions are designed to promote active trading. The Edison Electric Institute has suggested that administrative procedures governing transfers are overly complex and need to be streamlined further to encourage active trading.[131] Although the current plan requires that allowance transfers be signed by both parties and received and recorded by the Administrator before the permits will be amended, these minimal restrictions are necessary to ensure that trades are equal and enforceable.

Despite the fact that there are relatively few restrictions on individual trades, experience with current emissions trading pro-

126. S. 1630, *supra* note 102, at § 403(a)(2)(B).

127. S. REP. No. 228, *supra* note 19, at 323.

128. *Id.* at 325.

129. TEMPLE, BARKER & SLOANE INC., ECONOMIC EVALUATION OF H.R. 3030/S. 1490: "CLEAN AIR ACT AMENDMENTS OF 1989": TITLE V, THE ACID RAIN CONTROL PROGRAM 16 (prepared for The Edison Electric Institute, August 30, 1989).

130. *See* S. REP. No. 228, *supra* note 19, at 324.

131. TEMPLE, BARKER & SLOANE, INC., *supra* note 129, at 16.

grams suggests that firms may be tempted to stockpile allowances for their own use. To discourage hoarding of allowances, the program permits utilities to tailor commercial arrangements governing transfers of allowances to their individual needs.[132] Specifically, the use of leases as well as other short term transfer arrangements should discourage hoarding by giving utilities with excess allowances an opportunity to generate current income without jeopardizing future expansion.[133]

Firms could also stockpile allowances in an attempt to manipulate the market. Control of the market by one or even several firms would not only have a potentially adverse impact on other owners but could reduce economic efficiency.[134] The Report of the Senate Committee on Environment and Public Works on S. 1630, however, concludes that "all indications are that the market for allowances will be economically competitive and highly robust"[135] largely because ownership of allowances will not be concentrated but will be dispersed among a number of owners and operators.

In conclusion, a cap on emissions at a level that will stimulate demand for excess allowances coupled with relatively few restrictions on trading are critical to the development of an active and competitive market. Both President Bush's proposal and S. 1630 meet these basic requirements. Once the program is established, however, it will be important for the EPA to closely monitor the market to ensure that it is functioning smoothly.

4. Administration and Enforcement

Administration and enforcement of a broad based emissions trading program is crucial to its success. Specifically, without a system to effectively track and enforce permit allowances, firms will not have an incentive to meet their control requirements by either reducing their emissions or purchasing pollution allowances. This could hinder the development of a market and lead to increased environmental degradation.

132. S. REP. No. 228, *supra* note 19, at 320.

133. R. RAUFER & S. FELDMAN, ACID RAIN AND EMISSIONS TRADING: IMPLEMENTING A MARKET APPROACH TO POLLUTION CONTROL 133-34 (1987).

134. HAHN & NOLL, *supra* note 113, at 122; *Cf.* Misiolek and Elder, *Exclusionary Manipulation of Markets for Pollution Rights*, 16 J. ENVTL ECON. & MGMT. 156 (1989).

135. S. REP. No. 228, *supra* note 19, at 319.

The President's proposal relies on a system of permits issued by the Administrator in Phase I and by states with approved permit programs during Phase II to allocate allowances to affected sources. Permits will not be issued to affected sources unless the permit application includes a plan to comply with its annual tonnage limitation.[136] The bill requires the Administrator of EPA to promulgate regulations governing the subsequent transfer and use of emission allowances.[137] Sources that do not have permits sufficient to cover their allowed emissions are subject to a penalty of $2000 per ton and would be required to offset excess emissions in the following calendar year.[138]

To ensure that violations are detected, sources are required to install a continuous emissions monitoring system ("CEMS").[139] At year end, the CEMS data would be submitted to the EPA along with the firm's allowances for that year. By comparing CEMS data with the firm's allowances, EPA could determine whether an individual firm had complied with its permit.

It is difficult to determine in advance whether the proposed permit system will be effective. This problem is compounded by the fact that the proposed amendments delegate much of the responsibility for designing a monitoring program to the Administrator. But several factors suggest that the proposed monitoring and enforcement measures are adequate. First, simultaneous and continuous emissions monitoring systems will allow the EPA to not only ensure that individual units have complied with their permits but that emission reductions by sellers match emission increases by buyers. Second, since buyers will need to demonstrate at year end that they have acquired sufficient allowances to cover their annual emissions, there will be a built-in incentive to report and record trades. Finally, assuming the continuous emissions monitoring system is capable of detecting violations, the financial penalty for excess emissions combined with the requirement that any excess emissions be offset by emission reductions in the following calendar year should serve as a significant deterrent to potential violators.[140]

136. S. 1490, *supra* note 3, at § 507; S. 1630, *supra* note 102, at § 408.

137. S. 1490, *supra* note 3, at § 503(d); S. 1630, *supra* note 102, at § 403(d).

138. S. 1490, *supra* note 3, at § 510; S. 1630, *supra* note 102, at § 411.

139. S. 1490, *supra* note 3, at § 511(a); S. 1630, *supra* note 102, at § 412(a).

140. Permit violations may also be subject to administrative, civil, or criminal enforcement actions. S. 1490, *supra* note 3, at § 601; S. 1630, *supra* note 102, at § 601.

IV. CONCLUSIONS

Trading of sulfur dioxide and nitrogen oxide emission allowances could lead to a significant reduction in the cost of an acid rain program. The EPA has estimated, for example, that costs could be reduced by as much as fifty percent during Phase I of the program. During Phase II, cost savings would range from fourteen to twenty percent.[141]

The primary drawback of the proposed emissions trading program is that it may be difficult to administer and enforce because emissions can be increased or decreased by purchasing excess allowances from other sources that may be spread out over a wide geographic area. Poor administration and enforcement of emission permits, in turn, could jeopardize environmental objectives. On the other hand, experience with emissions trading programs under the current Clean Air Act suggests that stringent rules governing individual trades can inhibit the development of a competitive market, increasing the total costs of pollution control.

The President's proposal attempts to balance these potentially conflicting objectives by incorporating transfer restrictions into the initial design of the emissions trading program. The result is that there are relatively few restrictions on actual transfers over relatively broad geographic areas. This should keep transaction costs for participants to a minimum and improve the chance that a competitive market will develop, yielding potentially significant cost savings.

Although the initial distribution of allowances, the stringent limitations on emission rates and the use of CEMS are all designed to ensure that cost savings are not realized at the expense of environmental objectives, the success of the program ultimately depends on adequate administration and enforcement of individual trades. It is therefore essential that a system be estab-

141. S. REP. No. 228, *supra* note 19, at 316. For a more detailed economic analysis of the Administration's proposed Clean Air Act Amendments, *see* ICF RESOURCES INC., ECONOMIC ANALYSIS OF TITLE V (ACID RAIN PROVISIONS) OF THE ADMINISTRATION'S CLEAN AIR ACT AMENDMENTS (H.R. 3030/S. 1490) (prepared for the EPA, September 1989). *See also* ICF RESOURCES INC., ECONOMIC ANALYSIS OF TITLE IV (ACID RAIN PROVISIONS) OF THE SENATE BILL (S. 1630) (prepared for the EPA, January 1990). The cost savings projected by these studies are attributable not only to emissions trading but increased use of low sulfur coal. Although switching from high sulfur to low sulfur coal reduces compliance costs by eliminating the need for expensive scrubbers, the reduced demand for high sulfur coal would also result in the loss of as many as 16,000 coal mining jobs in high sulfur coal regions by the year 2000. *Id.* at 29.

lished to track and enforce emission trades that is effective but at the same time does not interfere with the development of a competitive market for pollution allowances.

In conclusion, the proposed emissions trading program is not a panacea. The cost of acid rain reduction, even with emissions trading, remains high and administration and enforcement of freely traded pollution allowances may be problematic. But with adequate supervision, a market approach could achieve the same environmental objectives as a system based on uniform standards, at significantly less cost. It therefore merits serious consideration.

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