1995

Twenty-Five Years of the Clean Air Act in Perspective

William Murray Tabb
University of Oklahoma College of Law, mtabb@ou.edu

Twenty-Five Years of the Clean Air Act in Perspective

Murray Tabb

The history of the Clean Air Act (CAA) has been marked by legal, philosophical, technical and scientific debates over various issues among industry, the Environmental Protection Agency (EPA), and environmental activist organizations. The complexities of the air pollution problem are reflected in the statutory framework—frequently criticized by business interests as inefficient, extraordinarily costly, and lacking sufficient scientific support. Some of the myriad difficult issues faced by Congress and EPA include:

- Which airborne pollutants present the greatest danger to human health and the environment?
- What properties or qualities make a pollutant "hazardous"?
- Does exposure to a high quantity of pollutant for a short period pose an equivalent health risk as exposure to a smaller dosage over an extended period?
- Which population group should be considered? Should the regulatory model "protect" all age groups? What if the projected cost of pollution reduction becomes exorbitant to gain a measure of protection for the most sensitive members of society: the aged, children, and the infirmed?
- Assuming that information exists regarding potential deleterious health effects of a particular pollutant for a specific population group measured over a determinable time period, at what level of exposure should EPA limit allowable emissions?
- Can health really be balanced and compared with cost issues? What is a life worth?
- Is the economic and technological feasibility of meeting regulatory standards relevant? What if the cost of achieving the mandated standards results in the closure of businesses and causes the loss of jobs?
- In deciding how to regulate, what advantages and disadvantages are presented by a technologically oriented model versus a health-based approach?

The search for "certainty" in regulating the multitude of sources that contribute to degradation of air quality is both elusive and intractable. Consequently, scientific certainty is replaced with phrases such as "risk assessment." Further, the appearance of certainty gains respectability under the guise of technological standards and phrases, such as "maximum achievable control technology" for regulating hazardous air pollutants. Numerous layers of uncertainty inevitably exist, however, in the process of regulation. These uncertainties and assumptions are frequently exposed and challenged by industry claiming EPA has been too stringent, and by environmental public interest groups clamoring for even tighter regulation. EPA is caught in the cross fire of the public debate and is often charged, at least in regulatory terms, with doing the impossible: protecting the public with "an ample margin of safety" without placing undue burdens on industrial development and progress.

Mr. Tabb is professor of law at the University of Oklahoma College of Law.

The Framework: National Ambient Air Quality Standards

The CAA has a twofold regulatory structure, combining health-based standards, which are set by determining the "safe" concentration level of a particular pollutant in the ambient air, with technology-based standards, which focus on reducing specified quantities of a pollutant within an industry's economic and technological capabilities. The Act regulates both stationary sources (e.g., power plants and industrial facilities) and mobile sources (automobiles, trucks and buses). The basic scheme of the Act since 1970 has been centered around the nationwide attainment and maintenance of federal emission limitations, National Ambient Air Quality Standards (NAAQS), for certain pollutants. NAAQS represent the maximum allowable concentrations of those pollutants in the ambient air throughout the United States. The specific emission standards that a source must meet will depend on whether the source is located in an area with "dirty" air or "clean" air—defined in reference to whether the region has "attained" the federal emission standards for the particular pollutant.

The regulatory process reflects both scientific and technical judgments by EPA regarding the significance of the health and environmental threats posed by exposure to airborne pollutants. "Air pollutant" for purposes of the CAA is broadly defined as "any air pollutant agent or combination of such agents, including any physical, chemical, biological, radioactive (including source material, special nuclear material, and byproduct material) substance or matter which is emitted into or otherwise enters the ambient air." CAA § 302(g), 42 U.S.C. § 7602(g). The first step in the regu-

latory process involves a determination by EPA that emissions of an air pollutant from numerous and diverse sources reasonably would be anticipated to "endanger" public health or welfare. CAA § 108(a)(1), 42 U.S.C. § 7408(a)(1). Based upon that determination and listing of the pollutant, EPA issues an air quality "criteria document" that contains the "latest scientific knowledge" regarding the identifiable effects on the public health and welfare caused by the pollutant. CAA § 108(a)(2), 42 U.S.C. § 7408(a)(2). Finally, EPA promulgates "primary" and "secondary" NAAQS for each of the criteria pollutants. CAA § 109(a)(2), 42 U.S.C. § 7409(a)(2).

The primary NAAQS reflect the maximum acceptable concentration of a pollutant in the ambient air, calculated over a designated averaging time that will protect the public health with an "adequate margin of safety." CAA § 109(b)(1), 42 U.S.C. § 7409(b)(1). Thus, the primary standards focus on protecting human health with a safety-oriented legislative methodology. The secondary NAAQS, on the other hand, are drawn to protect the public "welfare," which encompasses environmental and economic interests such as soil and water quality, recreational interests, and industrial concerns. CAA § 109(b)(2), 42 U.S.C. § 7409(b)(2).

NAAQS place a ceiling or cap on the allowable concentrations of the particular pollutant in the ambient air throughout the United States. Because NAAQS are a measure of the acceptable level of a pollutant in the air, they must be translated into specific limitations on the amount of a pollutant that an individual source may emit. The practical effect of NAAQS is to place emissions controls on existing sources and to affect the location of new sources. Yet since the inception of the 1970 version of the Act, EPA has listed for regulation only six criteria pollutants: suspended particulates, sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, and lead.

The primary standards focus on protecting human health with a safety-oriented legislative methodology.

Suspended particulates (TSPs) are solid or liquid particles, such as soot, ash, dust and chemicals, that remain suspended in the air after being released by various industrial and natural processes, such as burning fuel and automobile emissions. Suspended particulates adversely affect the human respiratory system and cause or exacerbate asthma and other respiratory and cardiovascular illnesses. Particulates also cause damage to building surfaces, hamper visibility, and detrimentally affect plant growth. Particulate emissions may be reduced through the use of electrostatic precipitators, filters, and scrubbers, which capture them before their release into the ambient air. EPA replaced its TSP standard in 1987 with a PM-10 standard, which focuses on smaller particles of less than 10 microns in diameter. The smaller particulates, which can be breathed into the lungs more easily, represent a greater health hazard than the larger, more visible particulates. Ambient levels of PM-10 have shown a consistent decrease over the past decade, partially reflecting tougher emission controls.

Sulfur dioxide (SO_2), a major source of acid rain, is a gas created through the combustion of fossil fuels. Several strategies employed to reduce sulfur dioxide include using low-sulfur fuels, extracting sulfur from fuels before burning, and removing sulfur by scrubbers. Between 1970 and 1987, the total annual emissions of SO_2 decreased 28 percent nationally. A major revision of the CAA in 1990 added Title IV, Acid Deposition Control, which aims to significantly reduce sulfur dioxide emissions through the allocation of "allowances" to major utilities.

Nitrogen dioxide (NO_2) principally enters the ambient air from automobile emissions and from coal-fired electric utilities. Nitrogen dioxide aggravates respiratory and cardiovascular problems, impairs visibility, interferes with plant growth, and contributes to urban smog.

Carbon monoxide (CO), is a poisonous, odorless and colorless gas that enters the bloodstream and impairs the transmission of oxygen to vital organs and tissues, contributes to cardiovascular disease, harms mental functions, and endangers fetal development. It accounts for the majority of greenhouse-gas emissions. Most carbon monoxide is generated by motor vehicle emissions. The pollutant is controlled principally through motor vehicle emission restrictions and the use of catalytic converters. Ambient levels of CO decreased approximately 37 percent between 1984 and 1993. The decrease came despite a 33 percent increase in vehicle miles traveled during that time.

Ozone (O_3), the principal component of smog, is not emitted directly into the atmosphere. Rather, ozone is indirectly produced as the result of a complex photochemical reaction when nitrogen oxides and volatile organic compounds (VOCs) are exposed to sunlight. Ozone gas is toxic to living organisms, causes respiratory and cardiovascular diseases, and impairs visibility. It damages crops and interferes with plant reproduction by contributing to the breakdown of the cellular structure. Ambient ozone levels decreased approximately 12 percent for the period 1984-1993, corresponding to tighter emissions controls for VOCs from automobiles.

Lead, a naturally occurring substance, is released into the air from gasoline combustion and various industrial processes. Lead accumulates in the body and impairs bone growth. Excessive concentrations of lead can cause neurological disorders, such as seizures, and present particular health risks to infants and fetuses. Significant progress has been made in reducing lead levels in the ambient air since the inception of the

Clean Air Act of 1970. From 1970 to 1987, total annual emissions of lead dropped from over 200 million tons to approximately 8 million tons—a 96 percent decrease. The majority of this decline is attributable to phasing out leaded gasoline.

Historical Obstacles to Attaining Clean Air

The Act requires each state to develop its own implementation plan (SIP) to accomplish the various federal mandates for both stationary and mobile sources. This areawide planning approach has several basic weaknesses, however. One obvious problem is that air currents transport pollution generated from sources located in one region to affect air quality in another locale. The sulfur dioxide and nitrogen oxides emitted from coal-fired plants in the industrial midwest, for example, may be carried hundreds of miles to contribute to the acid rain problem in the northeastern part of the United States and Canada. Another weakness is the difficulty in identifying and monitoring individual pollution sources. Although the idea of uniformity in application of NAAQS appeals to notions of geographic fairness and elimination of competitive advantage, the strategy was fundamentally flawed in failing to recognize fully that different regions of the country face vastly different pollution problems. Major metropolitan centers, such as Los Angeles, obviously encounter significantly more complex, severe, and intransigent air quality problems than do predominantly rural areas.

The CAA historically has been considered less effective than the Clean Water Act (CWA) for a variety of reasons. The CWA is broader in scope as "pollutant" includes an array of materials discharged into navigable waters, not circumscribed by a listing process of only potentially harmful pollutants like the CAA. The CWA structures its regulatory approach and permitting process around "point sources," thus capturing each individual discharger. In contrast, the basic focus of the CAA is on area plans, although amendments to the CAA do adopt some of the permitting features of the CWA with respect to major new and modified stationary sources. Finally, the scheme of the CWA is primarily quantitative and technological: the numerous industry groups are regulated according to phased-in levels of technology to improve the levels of effluent discharged. On the other hand, historically the CAA primarily has emphasized protection of health through a regulatory model designed around "safety." From an administrative standpoint, the difficulty with a health and safety orientation is the complication of several layers of scientific uncertainty in deciding what is safe and how best to protect society and the environment from unhealthy exposure to pollutants from numerous, diverse sources. In sum, the very flexibility that is so attractively presented in a health-based model has, in retrospect, backfired and resulted in administrative gridlock. EPA's task of sorting through mountains of information on various pollutants and making determinations regarding safety is staggering—particularly in light of short deadlines and inadequate staffing resources.

A key problem with a health-based approach to air quality is the relevance of cost and technological feasibility in achieving the standards imposed on industry by the EPA. In an early leading case, *Lead Industries Associates v. EPA*, 647 F.2d 1130 (D.C. Cir. 1980), industry groups challenged as scientifically unsound and economically ruinous an EPA standard regulating lead emissions on the basis that the standard was more stringent than necessary to protect public health. In setting the standards, EPA focused on protecting the most sensitive population groups—particularly children ages one to five. The agency sought to protect 99.5 percent of this target group from "unsafe" levels of lead concentration in the bloodstream.

The court upheld EPA's methods, reasoning that because the CAA revolved around protecting health by measuring regulation in terms of safety, EPA could not consider the cost of attaining the air quality standards. The court found that the removal of cost considerations in the standard-setting equation was part of a deliberate design by Congress to "subordinate" cost to the goal of achieving public health goals. Moreover, the court found that the structure of the Act had a "preventive and precautionary orientation," which gave considerable latitude to EPA to "err on the side of caution" in deciding which health risks to consider and the extent of the controls necessary to protect public health. Thus, in circumstances where scientific or medical evidence may prove inconclusive regarding potential health effects from exposure to certain pollutants, EPA nevertheless has considerable administrative discretion to establish regulatory standards.

The health-based "ample margin of safety" standard has sparked a heated debate (pitting industry's concern that the standards fail to consider cost-effectiveness against environmentalist's claims that EPA should regulate more stringently), leaving EPA with the dilemma of striking a balance between opposing views while trying to bring a measure of certainty to a process that is inherently imprecise. This emphasis on health presents both an administrative advantage and a disadvantage for EPA. In one respect, the agency is allowed wide discretion in deciding a litany of issues, such as the population segment, the quantum of exposure levels, the time periods and concentration levels of a pollutant, and the acceptable measures of risk. On the other hand, flexibility built into the statutory model renders actual implementation difficult and subject to the scrutiny and criticism of special interests, Congress, and with increasing frequency, the courts.

Prevention of Significant Deterioration

The 1970 version of the CAA contained no special measures to protect air quality in regions, such as national parks and wilderness areas, that had already attained national standards. Environmental organizations challenged EPA's position that it lacked authority to require such measures. They argued that the Act's statement of purpose was to "protect and enhance" the

quality of air resources. Congress subsequently amended the Act in 1977 and included provisions regarding the "prevention of significant deterioration" (PSD) of air quality in areas that already met or exceeded the national standards.

The PSD program is administered mainly through preconstruction review of new sources and modifications of existing emitting facilities. The source must demonstrate: that it will not cause a violation of existing NAAQS; that any emission of particulates or SO_2 will not cause a violation of statutory PSD increments; and that the source will employ the "best available control technology" (BACT) for each regulated pollutant that it emits. BACT is defined as a case-by-case determination of the maximum emission reduction that the facility can achieve taking into consideration cost, energy, and any nonair environmental impacts. CAA § 169(3), 42 U.S.C. § 7479(3).

Because the PSD requirements are pollutant-specific, the same geographic area may be designated as a "clean" air area for one pollutant while being designated as a "dirty" or nonattainment area for another pollutant. Accordingly, the PSD provisions can affect the location of new sources and thus may hinder economic growth in a region. One concern regarding the PSD provisions is that the permit system only covers major newly constructed or modified sources. The concept of "major" is determined by the unit's "potential to emit," taking into consideration the maximum design capacity of the source after application of pollution controls. CAA § 169(1), 42 U.S.C. § 7479(1). Numerous smaller sources, therefore, fall outside the scope of the Act and do not require preconstruction review or permit, yet their emissions contribute to the degradation of the air quality in the region. Because the PSD provisions regulate only "increments" of pollution beyond certain established baselines, it does not result in total nondegradation but only prevents "significant" amounts of additional pollution. Thus, it is not a "no-growth" policy but rather a measured growth program whereby pollution degradation is allowed within a range depending upon the classification of the area.

The effect of the statutory framework was administrative gridlock.

Hazardous Air Pollutants

The regulation of hazardous air pollutants (HAPs) under the CAA provides an interesting case study of the interrelationship of scientific uncertainty affecting administrative decisionmaking; the relevance of cost and technological feasibility; and the practical difficulties of applying health-based standards as the centerpiece of the regulatory model. The original design in the 1970 version of section 112 of the CAA authorized EPA to set nationally uniform emission standards for hazardous pollutants at a level that would provide an "ample margin of safety" to protect public health. CAA § 112(b)(2)(B), 42 U.S.C. § 7412(b)(1)(B). As a result of perceived difficulties in determining with any degree of scientific accuracy what constituted a "safe" level of exposure, EPA moved slowly in listing substances for regulation. After a decade, EPA had proposed regulatory standards for only four pollutants: asbestos, beryllium, mercury, and vinyl chloride. In 1984, EPA modified its approach and decided to incorporate risk assessment and limited consideration of costs and technological feasibility in the decisionmaking process.

EPA's methods for regulating vinyl chloride were shortly challenged in the watershed case, *Natural Resources Defense Council, Inc. v. EPA*, 824 F.2d 1146 (D.C. Cir. 1987). EPA had designed its standards to reduce emissions by 95 percent, the lowest level achievable through employment of the best available technology, considering cost and technological feasibility. The majority opinion, authored by Judge Robert Bork, found that EPA had inappropriately factored into the statutory formula considerations of economics and technological feasibility. Although the court acknowledged that "safe" was not synonymous with "risk-free" and that the agency's determination of risk could contain a measure of scientific uncertainty, the focus of section 112 was squarely on health, not economics.

Critics of the statutory approach claimed that it effectively created a "zero-risk" strategy because the agency could not reliably determine with reasonable scientific certainty any safe level of exposure to a carcinogenic substance. Consequently, to satisfy the statutory directive, EPA would potentially have been forced to draw standards at such stringent levels that the compliance costs and technological barriers could have resulted in widespread closure of segments of industry.

The effect of the statutory framework was administrative gridlock. EPA concluded that implementation of the safety policy was impracticable; accordingly, it simply chose not to initiate the listing process at all for pollutants potentially subject to classification as hazardous under the statute. The final tally for the period of 1970 through 1989 showed that EPA promulgated national emission standards for HAPs for only seven substances: arsenic, asbestos, benzene, beryllium, mercury, radionuclides, and vinyl chloride.

The monumental failure of the 1970 statutory design led to a significant shift in methods in the 1990 amendments to the Act. The amended Act sets forth a twofold approach for HAP regulation: a primary focus on technology controls backed up with a secondary phase that allows administrative gap-filling based on residual risk assessments. Congress, dismayed at EPA's inactivity in listing and regulating hazardous pollutants, took an unusual step and enumerated a list of 189 hazardous pollutants in the statute. Section 112, as amended, requires EPA to list all categories of major sources

and area sources of each listed pollutant and mandates a standard of "maximum degree of emission reduction achievable" (MACT) for all new and existing major sources in accordance with a statutory timetable. Although the revised section 112 abandons the centrality of a health-based model, modified safety standards were retained as a second phase of regulation to protect the public health with an ample margin of safety from any "residual risks" remaining after application of the MACT standard.

EPA does not establish controls for each substance but regulates toxic emissions based upon identifiable categories of industrial facilities. EPA issues standards for each source category, including both new and existing sources. EPA may add to the statutory list a pollutant that presents or may present a threat of adverse human health effects or adverse environmental effects. CAA § 112(b)(2), 42 U.S.C. § 7412(b)(2). Upon petition to EPA, the list may be modified to either add or delete a substance. CAA § 112(b)(3), 42 U.S.C. § 7412(b)(3). The MACT standards are accomplished through the Title V permit program, which prohibits new or modified construction of major sources without assurance of compliance.

The centerpiece of HAP regulation is the technology-based MACT standard. HAP emission standards must require the maximum degree of emission reductions that EPA determines to be "achievable," taking into consideration the cost of achieving the emission reduction and "any non-air quality health and environmental impacts and energy requirements." CAA § 112(d)(2), 42 U.S.C. § 7412(d)(2). Where a health threshold has been established for a pollutant, EPA may consider the threshold level, with an ample margin of safety, when establishing emission standards. CAA § 112(d)(4), 42 U.S.C. § 7412(d)(4). The revised statute offers EPA an expanded range of control measures, including application of "design, equipment, work practice, or operational standards." CAA § 112(h)(1), 42 U.S.C. § 7412(h)(1).

EPA issues standards for each source category, including both new and existing sources.

EPA must establish emission standards for new sources that require controls at least as stringent as the emission control "achieved in practice by the best controlled similar source." CAA § 112(d)(3), 42 U.S.C. § 7412(d)(3). Standards established for existing sources may be less stringent than those for new sources, but they must require at least the average emission limitation achieved by the best performing 12 percent of the existing sources in the same category, or for categories with fewer than thirty sources, by the best performing five sources. EPA may impose a standard based on "generally available control technologies or practices" (GACT) for area sources. CAA § 112(d)(5), 42 U.S.C. § 7412(d)(5). Categorization of sources is important, because the MACT standard is evaluated in reference to the performance of other sources in the same category or subcategory.

The second stage of HAP regulation allows for implementation of health-based standards after technology controls have been promulgated. CAA § 112(f), 42 U.S.C. § 7412(f). EPA must make an extensive report to the Congress by November 15, 1996, assessing the remaining risk to public health after application of the technology-based standards. The report must evaluate the significance to public health of the remaining risks; the available technologically and commercially feasible methods of reducing those risks; the actual health effects for persons living near the sources emitting hazardous pollutants; any available epidemiological or other health studies; any uncertainties in risk assessment; and must include any recommendations for further legislation regarding the remaining risk. CAA § 112(f)(1), 42 U.S.C. § 7412 (f)(1).

In promulgating any residual risk-emission standard, EPA must provide an ample margin of safety to protect public health. More stringent standards may be established if necessary to prevent adverse environmental effects, taking into consideration costs, energy, safety, and other relevant factors. CAA § 112(f)(2)(A), 42 U.S.C. § 7412 (f)(2)(A). EPA must make such a determination for each regulated category and subcategory of major sources listed under section 112(d), 42 U.S.C. § 7412(d), and develop additional standards if necessary to prevent adverse environmental effects or to protect public health. If the MACT standard still poses a lifetime excess cancer risk of one in one million or greater to individuals most exposed to the emission of a carcinogen, EPA must promulgate a residual risk emission standard that will provide an ample margin of safety.

In addition, the revised Act establishes a new program to prevent and minimize the consequences of an accidental release of hazardous air pollutants, such as the accident that occurred in Bhopal, India, in 1984. CAA § 112(r), 42 U.S.C. § 7412(r). Other new programs require the EPA Administrator to evaluate the effects of HAPs on the Great Lakes, Chesapeake Bay, and coastal waters, CAA § 112(m), 42 U.S.C. § 7412(m); to address regulation of radionuclide emissions, CAA § 112(d)(9), 42 U.S.C. § 7412(d)(9); to control incinerator emissions, CAA § 129, 42 U.S.C. § 7429; and to regulate coke oven emissions, CAA § 112(d)(8), 42 U.S.C. § 7412(d)(8).

The statute establishes a timetable with priorities for EPA to promulgate regulations of HAP source categories. CAA § 112(e), 42 U.S.C. § 7412(e). All categories and subcategories must be regulated by November 15, 2000. EPA recently announced a streamlined approach to establish MACT standards to accommodate the statutory deadlines. If EPA fails to meet the deadlines, states will make case-by-case determinations of what the federal standards would have been and then make independent decisions on those conclusions. To avoid a

potentially chaotic situation where state agencies are forced to make such decisions, EPA has sought to develop "partnerships" with various interested parties in gaining data and developing rules on a "fast track." In the first phase of the expedited process, EPA will develop a "presumptive MACT" that would represent a statement of current knowledge of relevant technologies and serve as a basis for developing an emission standard for the particular source category.

EPA has promulgated only about one-half of the MACT standards that were due in November 1994. The agency also has expressed concern about falling behind in developing the MACT standards due in 1997 and 2000. In a recent report by EPA's Office of Research and Development, the agency stated that it had inadequate data to initiate area resource risk assessments for most of the 189 HAPs listed in the statute. The challenge to meet the statutory timetable for HAP regulation presented by Congress to EPA was daunting; the measure of success of the program may depend largely on the ability of the agency to accumulate, assimilate, translate, and ultimately apply scientific data on HAPs within the prescribed time frames.

Regulation of Mobile Sources: Structure and Policy

Mobile sources, which principally include automobiles, trucks, and urban buses, are regulated under Title II of the CAA. Mobile vehicles account for approximately one-half of smog-causing VOCs and nitrogen oxides (NO_x) and between 75 percent to 90 percent of CO emissions. The human health costs and crop losses associated with exposure to vehicular air pollution have been estimated to reach $10 billion annually.

Although motor vehicle emissions have been regulated by Congress since 1965, the first major attempt to control emissions was in the 1970 CAA. The Act generally establishes uniform, national federal emissions limitations on various classes of vehicles, although California was allowed to promulgate standards that were more stringent than the federal Act. The 1970 version of the Act principally focused on the stringent tailpipe emission standards for new vehicles and various transportation control measures, such as state inspection and maintenance programs. Section 202(a)(1) of the Act prescribes emission standards for regulating classes (or families) of new motor vehicles which "cause or contribute to air pollution that may reasonably be anticipated to endanger public health or welfare." Section 202 standards reflect a combination of factors, including technology-forcing, environmental necessity, cost-effectiveness, fuel economy, noise, and safety.

Technology-forcing plays a key role in Title II as EPA has authority to require industry to meet emission standards that will require future installation of equipment and the use of processes that do not exist. Such leaps of scientific faith were justified on the rationale that it will force industry to find creative and innovative methods to meet the standard, and that absent such regulatory prodding industry would simply maintain the status quo. The major automotive manufacturers countered by claiming that the requisite technology to achieve the mandated standards would simply not be available within the prescribed timetable and that strict enforcement would result in the widespread loss of jobs and an economic crisis in the automobile industry.

The practice of technology-forcing with respect to reducing motor vehicle emissions resulted in acrimonious philosophical and pragmatic debates among industry, EPA and Congress. Under the CAA's 1970 framework, Congress established an ambitious and controversial policy mandating 90 percent reductions of hydrocarbons (HC) and CO emissions for new light-duty vehicles (passenger cars) by the 1975 model year and of NO_x by the 1976 model year. The major domestic and import automobile manufacturers promptly sought an extension of the deadlines for accomplishing the mandatory 90 percent reduction in emissions of HC and CO. EPA's denial of the extension was successfully challenged in *International Harvester v. Ruckelshaus*, 478 F.2d 615 (D.C. Cir. 1973). In a historic turn, the court agreed with the manufacturers that the requisite technology could not reasonably be projected scientifically to be available within the statutory time frame. On remand, EPA not only granted the extensions for HC and CO, but for NO_x as well.

The 90 percent "rollback" for HC and CO was ultimately postponed through a series of EPA waivers and congressional extensions, and the reductions were not implemented until the 1980 and 1981 model years, respectively. The 90 percent reduction of NO_x would not again be required under the Act until passage of the 1990 amendments. These technology-forcing standards did, however, lead to the development of the catalytic converter, which reduces harmful emissions through a chemical conversion process. A principal advantage to the converter is that it can be added to the exhaust system without requiring fundamental changes in basic engine design.

Emissions have also been controlled through regulation of fuels and fuel additives. EPA has focused its regulatory efforts on phasing out lead as a gasoline additive because it reduces the effectiveness of catalytic converters and also presents environmental and human health hazards. The lead phase-out culminates in the 1990 amendments, which prohibit the sale of fuel that contains lead or lead additives after December 31, 1995. CAA § 211(n), 42 U.S.C. § 7545(n).

A significant international development that changed the course of auto emission regulations was the Arab oil embargo of 1973-1974, which caused rapid escalation in the price of gasoline. The embargo prompted EPA to relax and extend the vehicle emission standards under Title II of the CAA. Congress established a tax on "gas guzzler" models and manufacturers began to downsize their vehicles to obtain better fuel economy.

There are several major mechanisms for enforcement of the motor vehicle emission standards in sec-

tion 202. EPA can review compliance at the prototype, assembly line, and in-use stages. Manufacturers must undertake a prototype certification process of "engine families," necessitating receipt of a certificate of conformity from EPA before the automobile can be introduced into interstate commerce. CAA § 203(a)(1), 42 U.S.C. § 7522(a)(1). EPA also may selectively test vehicles on the assembly line to determine if the prescribed percentage conforms to applicable standards. CAA § 206(b)(1), 42 U.S.C. § 7525(b)(1). The agency also can recall a class of vehicles in use if a substantial number fail to conform with standards throughout their "useful life." CAA § 207(c), 42 U.S.C. § 7541(c). Additionally, manufacturers must provide certain warranties to owners that guarantee that the new vehicle is designed, built, and equipped to conform with emission standards at the time of sale and that the vehicle is free from defects in materials or workmanship that would cause it to exceed standards within a designated warranty period after sale. CAA § 207(a), 42 U.S.C. § 7541(a). EPA has other basic enforcement powers, including the power to seek injunctions and penalties in court and to assess administrative penalties. CAA § 204-205, 42 U.S.C. § 7523-7524.

Although cars have become "cleaner" because of tighter controls on emissions over the past twenty-five years, the total number of cars and cumulative road miles traveled continues to increase dramatically. The continued growth in vehicle miles traveled has caused Congress to seek additional alternatives to curtail harmful emissions. The 1990 amendments to the Clean Air Act, although predominantly retaining the structure of the previous version of Title II, affect motor vehicle regulation in several significant respects. The amendments strengthen tailpipe emission standards, modify inspection and maintenance (I/M) programs, encourage the development of alternative clean fuels and clean vehicles, and provide more stringent regulation of fuel and fuel additives. The amendments give states more leeway with respect to transportation control plans and I/M programs in their SIPs. The programs are required only in certain nonattainment areas, based upon the classification of the area and the pollutant for which it is designated nonattainment.

The 1990 amendments establish programs to be phased-in between 1998 and 2000 to promote the use of "alternative fuels" that pollute less than gasoline (ethanol, natural gas, electricity). The amendments also provide for controlling sources of car emissions other than the tailpipe evaporative emissions, such as installation of on-board vapor recovery systems to capture fuel vapors. In nonattainment areas designated as extreme, severe or serious for ozone and carbon monoxide, the Act provides for use of fleets that must meet stringent standards for clean fuel vehicles.

Because the total number of allowances is fixed, the cap on pollution is accomplished.

Acid Rain: A Study in Market-Based Policy

SO_2 and NO_x emissions created by burning fossil fuels from electric- and steam-generating plants, petroleum refineries, nonferrous smelting plants, municipal incinerators, steel mills, and pulp and paper mills contribute to the formation of acid rain, which harms lakes and streams, trees, crops, historic buildings and monuments. The adverse human health effects associated with exposure to SO_2 include respiratory illness and aggravation of existing respiratory and cardiovascular disease particularly in children, the elderly, and persons with asthma. Chemical products emitted into the atmosphere, such as sulfates, nitrates, sulfuric acid, and nitric acid, may be transported hundreds of miles before falling to earth through dry deposition (in the form of gases) or wet deposition (rainfall or snow).

In an attempt to cut in half the total SO_2 emissions nationally by the year 2000, the 1990 amendments to the CAA added Title IV, Acid Deposition Control, which created a market-oriented system of permits to emit SO_2. The program marks an important symbolic as well as pragmatic shift from historic, traditional command-and-control methods of inflexible mandates toward a market-based system.

The underlying rationale of the new acid rain program is to let the market dictate the appropriate level of cost or value of the "right to pollute." The theory of the marketable allowance system is that reliance on free-marketplace dynamics will improve efficiency and cost-effectiveness and offer additional flexibility to industry. Title IV does not entirely replace the previous regulatory system of regulation, but coexists with other provisions of the Act, such as the NAAQS for SO_2. Because the total number of allowances is fixed, the cap on pollution is accomplished. A source holding an allowance has various options available, including use, banking credits for future use or transferring credits through sale to another plant that cannot afford the investment in new technologies.

The declared purpose of Title IV is to reduce the adverse effects of acid deposition through reductions in annual emissions of SO_2 by 10 million tons and NO_x by 2 million tons from 1980 emission levels. CAA § 401(b), 42 U.S.C. § 7642(b). The program, which affects approximately 2,200 existing units and most new utility units, revolves around the allocation and sale of "allowances" for SO_2 emissions. An "allowance" is defined as a limited authorization allocated to an electric utility plant or other source unit to emit one ton of SO_2 in a given year. CAA § 402(3), 42 U.S.C. § 7651a(3). EPA allocates allowances in two phases to 110 major electric utilities based on certain formulas involving their historical average fuel usage.

Critics of the program point out that most of the

pollution attributable to SO_2 remains outside the scope of the market-trading system. Also, it does not force the attainment of higher standards of cleaner air but rather tolerates continued pollution within the parameters of the allowances. Moreover, by permitting allowances to be traded, some sources responsible for the greatest amount of pollution may evade or postpone implementation of more efficient abatement technologies. This trading could exacerbate regional disparities and result in excessive concentrations of pollution in areas already exceeding attainment ceilings. Yet another concern is that excessive banking or saving of allowances for future use will impede the smooth functioning of the market.

To improve the liquidity of the allowance system and to ensure the availability of such allowances for utilities, the government began to sponsor sales and auctions of allowances. On March 29, 1993, the Chicago Board of Trade added a tradable commodity in SO_2 allowances. The proceeds from the March 27, 1995, sale of SO_2 allowances totaled $22.8 million at an auction sponsored by EPA and conducted by the Chicago Board of Trade. A total of 176,400 of three types of allowances were sold during the auction: spot, six-year advance (for year 2001), and seven-year advance (for year 2002).

EPA auctioned 50,000 spot allowances for use by utilities to meet emission reduction targets this year, the first compliance year under the acid rain program. Market observers suggest that the price of allowances, which averaged $132 in spot transactions, was lower than originally anticipated, reflecting a more educated and sophisticated market. Private citizens, ranging from grade school classes to environmental activist groups, have joined the major electric utilities in purchasing allowances. Citizen groups generally "retire" the allowances, permanently removing them from the market.

The Clean Air Act of the Future: Goals for 2005

EPA recently issued a draft summary report for public comment outlining wide-ranging goals for environmental protection for the next decade. The agency stated that its efforts were in response to the Government Performance and Results Act of 1993 and to the Clinton administration's promise to "reinvent government." The agency strategy calls for a "partnership" with America, focusing on encouraging innovation to improve effectiveness in pollution control and to reduce the cost of compliance with environmental laws. The EPA approach to promote cost reduction was through enhanced efficiency and flexibility, using information and economic incentives to accomplish its aims rather than more direct regulation. EPA outlined the following benchmarks for achievement by the year 2005:

- Reducing to six the number of metropolitan areas that do not meet air quality standards (the agency acknowledged that meeting this objective still would leave approximately 45 million Americans who will be living in areas without "clean" air).
- Reducing motor vehicle emissions of smog-causing VOCs 65 percent from 1990 levels.
- Reducing toxic air emissions from major industrial facilities to the lowest technically achievable levels (the number of industrial categories with the lowest technically achievable toxic air emissions would increase from 6 in 1995 to 174 in 2005).
- Decreasing SO_2 emissions, the leading cause of acid rain, 32 percent from 1994 levels (this also reflects a reduction of 40 percent from pre-1990 levels).
- Improving the annual average visibility in the eastern United States from 10 percent to 30 percent.

In addition, EPA seeks to stabilize atmospheric greenhouse-gas emissions, including carbon monoxide, nitrous oxide, and halogenated fluorocarbons to 1990 levels. Finally, the EPA policy would seek restoration of the earth's stratospheric ozone layer, partially by elimination of U.S. production of ozone-depleting substances except hydrochlorofluorocarbons. Interestingly, EPA recognized that some of the critical flaws in the regulatory process include limited availability of good national-level data on environmental conditions and the ability to reliably relate the data to risk assessment.

As the Republicans seek to implement their Contract with America in the 104th Congress, the potential for dramatically altering the focus and impact of the CAA moves closer to reality. Three dominant issues emerge that could have major repercussions in environmental law: (1) incorporating peer review and cost-benefit analysis in legislation and in risk assessment; (2) curbing the historical practice of unfunded mandates on states and local governments; and (3) enhancing protection for private property rights by providing compensation for landowners whose property values are diminished as a result of federal limitations on land use. Proponents of these reform measures herald them as necessary to reintroduce critical notions of cost accountability into the regulatory equation. Critics charge that shifting the emphasis from a health and environmental protection model to a cost-efficiency model effectively rolls back twenty-five years of progress.

The CAA has come under increasing criticism by industry on the ground that the costs of compliance hamper the ability to maintain competitiveness in a global economy. Targeted by industry coalitions are EPA regulations requiring enhanced monitoring, the Title V permitting procedures, and regulations concerning hazardous pollutants. The future of the CAA as presently oriented hinges on the nature of the resolution of these political battles. The Act, as with other legislative efforts, reflects an array of political choices, compromises, and occasional experiments, suggesting that the interplay of science and technology that has undergirded the Clean Air Act for twenty-five years will remain central in whatever form Congress ultimately chooses to promulgate.