
Regulating Air Pollution

I. INTRODUCTION

The US Clean Air Act Amendments of 1990 (CAAA90) [1] were a revision of the original US Clean Air Act passed in 1963, amended in 1970, and amended again in 1977 [2]. It is one of the most significant pieces of environmental legislation ever enacted. Estimates of the yearly economic impacts of CAAA90 range from US \$12 to US \$53 billion in 1995 and from US \$25 to US \$90 billion by 2005.

CAAA90 is a technology-based program rather than the health-based program used in the original Clean Air Act (CAA). The standards and emission limits are based on Maximum Achievable Control Technology (MACT). The final emission limits are set forth in permits issued by the individual states.

Stenvaag, in his book, *Clean Air Act 1990 Amendments Law and Practices* [3], has written:

By far the most important interpretive documents have not yet been written: the countless EPA regulations, decisions, and explanatory preambles that must be published in the Federal Register to carry out the Act. As these rulings are systematically promulgated over the coming decades, flesh and muscle will be added to the massive skeleton of the 1990 amendments and we will all gain a better understanding of what the 101st Congress has wrought.

II. TITLES

CAAA90 contains 11 "Titles." Some of these are new, and some are greatly expanded from similar titles in the original CAA.

A. Title I: Provisions for Attainment and Maintenance of National Ambient Air Quality Standards

Title I changed the existing nonattainment program of the original Clean Air Act Title I, Part D, by establishing new nonattainment requirements for ozone, carbon monoxide (CO), and particulate matter (PM₁₀). Also, the new nonattainment requirements vary from location to location and with the severity of nonattainment. The changes are accomplished through revisions of the State Implementation Plan (SIP). The SIP must designate "milestones" according to specified timetables. Failure to meet milestones results in mandatory sanctions.

The most widespread and persistent urban pollution problem is ozone. The causes of this and the lesser problem of CO and PM₁₀ pollution in our urban areas are largely due to the diversity and number of urban air pollution sources. One component of urban smog, hydrocarbons, comes from automobile emissions, petroleum refineries, chemical plants, dry cleaners, gasoline stations, house painting, and printing shops. Another key component, nitrogen oxides, comes from the combustion of fuel for transportation, utilities, and industries.

Although there are other reasons for continued high levels of ozone pollution, such as growth in the number of stationary sources of hydrocarbons and continued growth in automobile travel, the remaining sources of hydrocarbons are the most difficult to control. These are the small sources, those that emit less than 100 tons of hydrocarbons per year. These sources, such as auto shops and dry cleaners, may individually emit less than 10 tons per year but collectively emit many hundreds of tons of pollution.

Title I allows the EPA to define the boundaries of "nonattainment" areas for ozone, CO, and PM₁₀. Emission standards for these areas are based on a new set of "nonattainment categories." EPA has established a classification system for ozone design values (goals) and attainment deadlines. Table 26.1 lists these parameters.

TABLE 26.1

Classification and Attainment Dates for Ozone Nonattainment Areas

Classification	Ozone design values	Attainment deadline (from enactment)
Marginal	0.121 up to 0.138 ppm	1993 (3 years)
Moderate	0.138 up to 0.160 ppm	1996 (6 years)
Serious	0.160 up to 0.180 ppm	1999 (9 years)
Severe	0.180 up to 0.280 ppm	2005 (15 years)
Extreme	0.280 ppm and above	2010 (20 years)

TABLE 26.2

Title I Emission Sources Requiring Control

EPA ozone nonattainment classification	Allowable emissions of NO _x and VOC combined (tons per year)
Extreme and severe	10
Serious	50
Moderate and marginal	100

If a nonattainment area is classified as serious, based on ambient ozone measurements, then the state must modify its SIP to bring the area into compliance in 9 years. The CAAA90 also specify the size and, therefore, the number of sources subject to regulatory control as a function of nonattainment classification. Table 26.2 illustrates these requirements for ozone nonattainment classifications of extreme and severe; the state must include sources with combined NO_x and VOC emissions of 10 tons per year in their control plans.

As mentioned, nonattainment areas must implement different control measures, depending on their classification. Marginal areas, for example, are the closest to meeting the standard. They are required to conduct an inventory of their ozone-causing emissions and institute a permit program. Nonattainment areas with more serious air quality problems must implement various control measures. The worse the air quality, the more control areas will have to implement.

The new law also establishes similar programs for areas that do not meet the federal health standards for the pollutants carbon monoxide and particulate matter. Areas exceeding the standards for these pollutants are divided into "moderate" and "serious" classifications. Depending on the degree to which they exceed the carbon monoxide standard, areas are required to implement programs introducing oxygenated fuels and/or enhanced emission inspection programs, among other measures. Depending on their classification, areas exceeding the particulate matter standard will have to implement either Reasonably Available Control Technology (RACT) or Best Available Control Technology (BACT), among other requirements.

B. Title II: Provisions Related to Mobile Sources

Title II of the CAAA90 is related mainly to vehicles that operate on roads and highways. Off-road, or nonroad, engines and vehicles used for site drilling, remediation, or related construction may be regulated if the administrator of EPA determines that some degree of emission reduction is necessary.

The EPA has summarized the provisions related to mobile sources [4] as follows:

While motor vehicles built today emit fewer pollutants (60% to 80% less, depending on the pollutant) than those built in the 1960s, cars and trucks still account for almost half the emissions of the ozone precursors VOCs and NO_x, and up to 90% of the CO emissions in urban areas. The principal reason for this problem is the rapid growth in the number of vehicles on the roadways and total miles driven. This growth has offset a large portion of the emission reductions gained from motor vehicle controls.

In view of the unforeseen growth in automobile emissions in urban areas combined with the serious air pollution problems in many urban areas, the Congress has made significant changes to the motor vehicle provisions on the 1977 Clean Air Act.

The Clean Air Act of 1990 establishes tighter pollution standards for emissions from automobiles and trucks. These standards will reduce tailpipe emissions of hydrocarbons, carbon monoxide, and nitrogen oxides on a phased-in basis beginning in model year 1994. Automobile manufacturers will also be required to reduce vehicle emissions resulting from the evaporation of gasoline during refueling.

Fuel quality will also be controlled. Scheduled reductions in gasoline volatility and sulfur content of diesel fuel, for example, will be required. New programs requiring cleaner (so-called "reformulated" gasoline) will be initiated in 1995 for the nine cities with the worst ozone problems. Other cities can "opt in" to the reformulated gasoline program. Higher levels (2.7%) of alcohol-based oxygenated fuels will be produced and sold in 41 areas during the winter months that exceed the federal standard for carbon monoxide.

The new law also establishes a clean fuel car pilot program in California, requiring the phase-in of tighter emission limits for 150 000 vehicles in model year 1996 and 300 000 by the model year 1999. These standards can be met with any combination of vehicle technology and cleaner fuels. The standards become even stricter in 2001. Other states can 'opt in' to this program, though only through incentives, not sales or production mandates.

Further, 26 of the dirtiest areas of the country will have to adopt a program limiting emissions from centrally fueled fleets of 10 or more vehicles beginning as early as 1998.

C. Title III: Hazardous Air Pollutants

Toxic air pollutants are pollutants which are hazardous to human health or the environment but which are not specifically regulated by the CAA. These pollutants are typically carcinogens, mutagens, and teratogens. The CAAA of 1977 failed to result in substantial reductions in the emissions of these harmful substances.

The toxic air pollution problem is widespread. Information generated from the Superfund "Right to Know" rule from the Superfund Authorization and Recovery Act (SARA Section 313) indicates that more than 2.7 billion pounds of toxic air pollutants are emitted annually in the United States. EPA studies indicate that exposure to such quantities of air toxics may result in 1000-3000 cancer deaths each year.

The CAAA90 offers a comprehensive plan for achieving significant reductions in emissions of hazardous air pollutants from major sources. The law

has improved EPA's ability to address this problem effectively and it has accelerated progress in controlling major toxic air pollutants.

EPA issued MACT standards for each listed source category according to a prescribed schedule. These standards are based on the best demonstrated control technology or practices within the regulated industry, and EPA was required to issue the standards for 40 source categories within 2 years of passage of the new law. The remaining source categories are controlled according to a schedule which ensures that all controls will have been achieved within 10 years of enactment. Companies that voluntarily reduce emissions according to certain conditions can get a 6-year extension to meet the MACT requirements.

Eight years after MACT is installed on a source, EPA must examine the risk levels remaining at the regulated facilities and determine whether additional controls are necessary to reduce unacceptable residual risk.

The EPA developed [4] a one-page summary of the key points of Title III. The following is this summary.

1. Title III: Air Toxics, Key Points

- *List of Pollutants and Source Categories:* The law lists 189 hazardous air pollutants. One year after enactment EPA lists source categories (industries) which emit one or more of the 189 pollutants. In 2 years, EPA must publish a schedule for regulation of the listed source categories.
- *MACT:* MACT regulations are emission standards based on the best demonstrated control technology and practices in the regulated industry. MACT for existing sources must be as stringent as the average control efficiency or the best controlled 12% of similar sources excluding sources which have achieved the lowest achievable emission rate (LAER) within 18 months prior to proposal or 30 months prior to promulgation. MACT for new sources must be as stringent as the best controlled similar source. For all listed major point sources, EPA must promulgate MACT standards—40 source categories plus coke ovens within 2 years and 25% of the remainder of the list within 4 years, an additional 25% in 7 years, and the final 50% in 10 years.
- *Residual Risk:* 8 years after MACT standards are established (except for those established 8 years after enactment), standards to protect against the residual health and environmental risks remaining must be promulgated, if necessary. The standards would be triggered if more than one source in a category exceeds a maximum individual risk of cancer of 1 in 1 million. These residual risk regulations would be based on current CAA language that specifies that standards must achieve an "ample margin of safety."
- *Accidental Releases:* Standards to prevent against accidental release of toxic chemicals are required. EPA must establish a list of at least 100 chemicals and threshold quantities. All facilities with these chemicals on site in excess of the threshold quantities would be subject to the regulations which would include hazard assessments and risk management

plans. An independent chemical safety board is established to investigate major accidents, conduct research, and promulgate regulations for accidental release reporting.

D. Title IV: Acid Deposition Control

The EPA summary [4] of Title IV states the basics of the acid deposition control amendments:

Acid deposition occurs when sulfur dioxide and nitrogen oxide emissions are transformed in the atmosphere and return to the earth in rain, fog or snow. Approximately, 20 million tons of SO₂ are emitted annually in the United States, mostly from the burning of fossil fuels by electric utilities. Acid rain damages lakes, harms forests and buildings, contributes to reduced visibility, and is suspected of damaging health.

The new Clean Air Act will result in a permanent 10 million ton reduction in sulfur dioxide (SO₂) emissions from 1980 levels. To achieve this, EPA will allocate allowances of 1 ton of sulfur dioxide in two phases. The first phase, effective January 1, 1995, requires 110 powerplants to reduce their emissions to a level equivalent to the product of an emissions rate = (2.5 lbs of SO₂/mm Btu) × (the average mm Btu of their 1985–1987 fuel use). Plants that use certain control technologies to meet their Phase I reduction requirements may receive a 2-year extension of compliance until 1997. The new law also allows for a special allocation of 200 000 annual allowances per year each of the 5 years of Phase I to powerplants in Illinois, Indiana and Ohio.

The second phase, becoming effective January 1, 2000, will require approximately 2000 utilities to reduce their emissions to a level equivalent to the product of an emissions rate of (1.2 lbs of SO₂/mm Btu) × (the average mm Btu of their 1985–1987 fuel use). In both phases, affected sources will be required to install systems that continuously monitor emissions in order to track progress and assure compliance.

The new law allows utilities to trade allowances within their systems and/or buy or sell allowances to and from other affected sources. Each source must have sufficient allowances to cover its annual emissions. If not, the source is subject to a \$2,000/ton excess emissions fee and a requirement to offset the excess emissions in the following year.

Nationwide, plants that emit SO₂ at a rate below 1.2 lbs mm⁻¹ Btu will be able to increase emissions by 20% between a baseline year and 2000. Bonus allowances will be distributed to accommodate growth by units in states with a statewide average below 0.8 lbs mm Btu. Plants experiencing increases in their utilization in the last 5 years also receive bonus allowances. 50 000 bonus allowances per year are allocated to plants in 10 midwestern states that make reductions in Phase I. Plants that repower with a qualifying clean coal technology may receive a 4 year extension of the compliance date for Phase II emission limitations.

The new law also includes specific requirements for reducing emissions of nitrogen oxides, based on EPA regulations to be issued not later than mid-1992 for certain boilers and 1997 for all remaining boilers.

Title IV represents legislation designed to reduce total SO₂ emissions by approximately 50% over a 10-year period. Provisions of the title are designed to introduce economic flexibility for the electric power industry, to recognize controls already implemented by progressive utilities and to reduce the economic impact on high-sulfur coal regions of the United States.

E. Title V: Permits

The 1990 law introduced an operating permits program modeled after a similar program under the Clean Water Act's National Pollution Elimination Discharge System (NPDES) law. The purpose of the operating permits program is to ensure compliance with all applicable requirements of the CAAA90 and to enhance EPA's ability to enforce the Act. Air pollution sources subject to the program must obtain an operating permit; states must develop and implement the program; and EPA must issue permit program regulations, review each state's proposed program, and oversee the state's efforts to implement any approved program. EPA must also develop and implement a federal permit program when a state fails to adopt and implement its own program. The final rulemaking for this Title V program was published on July 21, 1992 as Part 70 of Chapter I of Title 40 of the Code of Federal Regulations (57FR32250).

The program clarifies and makes more enforceable a source's pollution control requirements. Currently, a source's pollution control obligations may be scattered throughout numerous hard-to-find provisions of state and federal regulations, and in many cases, the source is not required, under the applicable SIP, to submit periodic compliance reports to EPA or the states. The permit program ensures that all of a source's obligations with respect to its pollutants are contained in one permit document and that the source will file periodic reports identifying the extent to which it has complied with those obligations. Both of these requirements greatly enhance the ability of federal and state agencies to evaluate a source's air quality situation.

In addition, the program provides a ready vehicle for states to assume administration, subject to federal oversight, of significant parts of the air toxics program and the acid rain program. Through the permit fee provisions discussed later, the program greatly augments a state's resources to administer pollution control programs by requiring sources of pollution to pay their fair share of the costs of a state's air pollution program.

Under the 1990 law, EPA was required to issue program regulations by November 15, 1991. By November 15, 1993, each state must submit to EPA a permit program meeting these regulatory requirements. After receiving the state submittal, EPA has 1 year to accept or reject the program. EPA must level sanctions against a state that does not submit or enforce a permit program.

If a state fails to comply, EPA will promulgate and administer the state's program. That could mean lengthy permitting delays and additional paperwork. By supporting the state's permitting authority, a facility can simplify the permitting process and avoid EPA intervention.

Each permit issued to a facility is for a fixed term of up to 5 years. The new law establishes a permit fee whereby the state collects a fee from the permitted facility to cover reasonable direct and indirect costs of the permitting program.

All sources subject to the permit program must submit a complete permit application within 12 months of the effective date of the program. The state

permitting authority must determine whether or not to approve an application within 18 months of the date it receives the application.

To ensure compliance with the standards, the permit also must contain provisions for the inspection, entry, monitoring, certification, and reporting of compliances with the permit conditions.

EPA has 45 days to review each permit and to object to permits that violate the CAAA. If EPA fails to object to a permit that violates the Act or the implementation plan, any person may petition EPA to object within 60 days following EPA's 45-day review period, and EPA must grant or deny the permit within 60 days. Judicial review of EPA's decision on a citizen's petition can occur in the federal court of appeals. The public is guaranteed the right to inspect and review all permit applications and documents. There are provisions for three kinds of permit revisions: administrative amendment, minor permit modification, and significant modification.

These regulations will apply to an estimated 34 000 "major" industrial sources. "Major" sources are defined according to their "potential to emit" and the cutoff levels vary depending on both the pollutant and the local areas' compliance status with the National Ambient Air Quality Standard (NAAQS) for that pollutant. For the present, the EPA has exempted all "non-major" sources, of which there are estimated to be about 350 000, from this permitting, until they have studied further the feasibility of permitting them. However, the states can require permitting of some of these sources.

The regulations provide for the collection of fees from permit seekers and the states must require fees sufficient to cover the cost of administering the program. If a state does not submit, properly administer, or enforce a permit program, federal sanctions must be levied including the withholding of highway funds and requiring offset pollution for new sources by reducing emissions by 2 tons from existing sources for every 1 tons of emissions from a proposed new source.

All permits must include a cap on emissions which cannot be exceeded without an approved revision of the permit. Permitted sources must periodically test and monitor their emissions and report on these activities every 6 months. Civil penalties include fines of not less than \$10 000 per day for permit violations and criminal penalties for deliberate false statements or representations, or for rendering any inaccurate monitoring device or method required in the permit.

F. Title VI: Stratospheric Ozone Protection

The EPA summary [4] for stratospheric ozone and global climate protection lists the basics of the title:

The new law builds on the market-based structure and requirements currently contained in EPA's regulations to phase out the production of substances that deplete the ozone layer. The law requires a complete phase-out of CFCs and halons with

interim reductions and some related changes to the existing Montreal Protocol, revised in June 1990.

Under these provisions, EPA must list all regulated substances along with their ozone-depletion potential, atmospheric lifetimes and global warming potentials within 60 days of enactment.

In addition, EPA must ensure that Class I chemicals be phased out on a schedule similar to that specified in the Montreal Protocol—CFCs, halons, and carbon tetrachloride by 2000; methyl chloroform by 2002—but with more stringent interim reductions. Class II chemicals (HCFCs) will be phased out by 2030. Regulations for Class I chemicals will be required within 10 months, and Class II chemical regulations will be required by December 31, 1999.

The law also requires EPA to publish a list of safe and unsafe substitutes for Class I and II chemicals and to ban the use of unsafe substitutes.

The law requires nonessential products releasing Class I chemicals to be banned within 2 years of enactment. In 1994 a ban will go into effect for aerosols and non-insulating foam using Class II chemicals, with exemptions for flammability and safety. Regulations for this purpose will be required within 1 year of enactment, to become effective 2 years afterwards.

G. Title VII: Provisions Relating to Enforcement

The CAAA90 contains a broad array of authorities to make the law more readily enforceable, thus bringing it up to date with the other major environmental statutes. EPA has new authorities to issue administrative penalty orders up to US \$200 000 and field citations up to US \$5000 for lesser infractions. Civil judicial penalties are enhanced. Criminal penalties for knowing violations are upgraded from misdemeanors to felonies, and new criminal authorities for knowing and negligent endangerment are established.

In addition, sources must certify their compliance, and EPA has authority to issue administrative subpoenas for compliance data. EPA will also be authorized to issue compliance orders with compliance schedules of up to 1 year.

The citizen suit provisions have also been revised to allow citizens to seek penalties against violators, with the penalties going to a US Treasury fund for use by EPA for compliance and enforcement activities. The US Government's right to intervene is clarified and citizen plaintiffs will be required to provide the US Government with copies of pleadings and draft settlements.

Any atmospheric emissions for which EPA does not develop standards may be regulated by state or regional authorities.

A review of the enforcement and liability provisions of CAAA90 [5] recommends that because of the new enforcement tools available to the federal government, the regulated community should implement effective self-auditing and compliance programs at facilities to reduce the risk of criminal liability. Stenvaag [3] covers the provisions relating to enforcement from a legal standpoint. He states the new language of this title to be "quite confusing, particularly in specifying when criminal sanctions are appropriate."

H. Title VIII: Miscellaneous Provisions

Section 130, Emission Factors requires revising emission inventory factors every 3 years:

Within 6 months after enactment of the Clean Air Act Amendments of 1990, and at least every 3 years thereafter, the Administrator shall review and, if necessary, revise, the methods ('emission factors') used for purposes of this Act to estimate the quantity of emissions of carbon monoxide, volatile organic compounds, and oxides of nitrogen from sources of such air pollutants (including area sources and mobile sources). In addition, the Administrator shall permit any person to demonstrate improved emissions estimating techniques, and following approval of such techniques, the Administrator shall authorize the use of such techniques. Any such technique may be approved only after appropriate public participation. Until the Administrator has completed the revision required by this section, nothing in this section shall be construed to affect the validity of emission factors established by the Administrator before the date of the enactment of the Clean Air Act Amendments of 1990.

I. Title IX: Clean Air Research

Title IX of the CAAA90 addresses air pollution research areas including monitoring and modeling, health effects, ecological effects, accidental releases, pollution prevention and emissions control, acid rain, and alternative motor vehicle fuels. The provisions require ecosystem studies on the effects of air pollutants on water quality, forests, biological diversity, and other terrestrial and aquatic systems exposed to air pollutants; mandate the development of technologies and strategies for air pollution prevention from stationary and area sources; and call for several major studies. The EPA must improve methods and techniques for measuring individual air pollutants and complex mixtures and conduct research on long- and short-term health effects, including the requirement for a new interagency task force to coordinate these research programs. Finally, the Agency must develop improved monitoring and modeling methods to increase the understanding of tropospheric ozone formation and control.

To implement the research provisions, the EPA plans to conduct research in emissions inventories, atmospheric modeling, source/ambient monitoring, control technologies, health, and ecological monitoring. Both ecological monitoring and ambient monitoring are to be done jointly with other agencies who also need these data to meet their mission. Other proposed work includes developing improved risk assessment methods, maintaining existing networks or establishing new ones for aquatic and terrestrial effects monitoring, and continuing work on deposition chemistry. Again, these efforts in particular are to be supported, in part, by other agencies.

J. Title X: Disadvantaged Business Concerns and

Title XI: Clean Air Employment Transition Assistance

These two final titles were added to cover the subject areas of concern. They relate to procedural matters and direct the appropriate federal agencies to implement and oversee the necessary compliance action.

REFERENCES

1. Public Law No. 101-549; 101st Congress, November 15, 1990, An Act to amend the Clean Air Act to provide for attainment and maintenance of health protective national ambient air quality standards, and for other purposes.
2. US Public Law No. 88-206, 77 Stat. 392 (1963), US Public Law No. 91-604, 84 Stat. 1676 (1970), US Public Law No. 95-95, 91 Stat. 686 (1977).
3. Stenvaag, J. M., *Clean Air Act 1990 Amendments Law and Practices*. Wiley, New York, 1991.
4. Office of Air and Radiation, US Environmental Protection Agency, *The Clean Air Act Amendments of 1990, Summary Materials*, November 1990.
5. Elliott, E. D., Schwartz, R. M., Goldman, A. V., Horowitz, A. B., and Laznow, J., The Clean Air Act: new enforcement and liability provisions. *J. Air Waste Manage. Assoc.* **42** (11), 1261-1270 (1992).

SUGGESTED READING

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- Gas Research Institute briefing on Clean Air Act Amendments of 1990. Presentation by J. G. Holmes and R. W. Crawford, Energy and Environmental Analysis, Inc., December 1990.
- Lee, B., Highlights of the Clean Air Act Amendments of 1990. *J. Air Waste Manage. Assoc.* **41** (1), 48-55 (1991).
- Quarles, J., and Lewis Jr., W. H., *The New Clean Air Act: A Guide to the Clean Air Program as Amended in 1990*. Lewis and Brockius, Washington, DC, 1990.
- US Environmental Protection Agency (EPA), *Implementation Strategy for the Clean Air Act Amendments of 1990*. EPA Office of Air and Radiation, Washington, DC, January 15, 1991.

QUESTIONS

1. Give an example of a health-based air pollution standard with the justification for the standard.
2. Give an example of a technology-based air pollution standard with the justification for the standard.
3. Choose a specific metropolitan area and determine its classification as an ozone nonattainment area. Find the alternative deadline and allowable emissions of NO_x and VOC combined.
4. For the specific metropolitan area in question 3, discuss how the attainable deadline and allowable emissions can be met.
5. List the alternatives that are possible to replace present automobiles with vehicles, or systems, that will reduce emissions of VOCs, NO_x , and CO.
6. List five categories (such as hazardous waste incineration) that may be considered as "major" or "area" sources of hazardous air pollutants.
7. Develop an outline of a permit for a new plastic molding company. Include a schedule of costs and reporting requirements.