Using the Wrong Measures for Smog

James Lis and Kenneth Chilton

According to the air-quality measure defined in the 1990 Clean Air Act Amendments (CAAA), 94 metropolitan areas have "unhealthy" air due to ground-level ozone pollution. Is the problem really this serious or does the method of measuring smog levels overstate the case?

At least some members of Congress must have had their doubts about the current air-quality measure because amid the 800 pages of the CAAA lies a short technical provision, requiring that the Environmental Protection Agency (EPA) analyze the form of the ozone "design value." That statistic is used by EPA to define the severity of ground-level (tropospheric) ozone in America's cities.

The EPA was to report to Congress, by November 1993, on whether its methodology "for establishing a design value for ozone provides a reasonable indicator of the ozone air quality" in areas that fail to meet the national standard for this pollutant, the so-called "nonattainment" areas. Having missed that deadline,the EPA published a draft study in March 1994. Before completion and submission to Congress, the EPA's study will first undergo a 30-day peer review and public comment period.

This article will discuss the reasonableness of the current ozone design value and comments on the EPA's draft report. It also addresses the costs imposed on the public and private sectors as a result of this seemingly technical issue.

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Key Concepts and Terms

In accordance with the Clean Air Act, EPA has established a 0.12 parts per million (ppm) National Ambient Air Quality Standard (NAAQS) for ozone in order to protect public health and welfare. An exceedance of this standard occurs if the hourly average ozone concentration measured at an air-quality monitor tops the 0.12 ppm threshold during a day. An area violates the NAAQS, and, thus, is designated nonattainment, if any one of its air-quality monitors registers more than three exceedances in a consecutive three-year period. Stated differently, an area is classified as nonattainment if any monitor's fourth-highest one-hour-average monitor reading taken during the most recent three-year period registers above 0.12 ppm. A monitoring site's "design value" is this fourth-highest one-hour reading. The highest design value among all of the monitoring sites in an area ultimately becomes the design value for the entire area.

Spatial Limits

The design-value statistics' reliance on conditions at a single monitoring site proves to be a serious shortcoming. The EPA's design-value report concludes that, due to variability at monitoring sites across urban areas, "one cannot expect a single numerical value to adequately describe complex concentration gradients across large metropolitan areas." In other words, a single site fails to offer a fair overall representation of the air quality throughout a nonattainment area.

In the past, the EPA has suggested that if research were to demonstrate, as it now has, that ozone levels vary significantly within a nonattainment area, an improved design value could include an average of a representative set of monitors in a given area. Thomas Curran of EPA's Office of Air Quality Planning and Standards says that such a "network interpretation" may better describe an area's overall ozone problem.

Fluctuations in weather make it difficult to draw conclusions about the effectiveness of ozone-control strategies. Either changing weather or varying levels of precursor emissions can account for shifts in ozone concentrations.

The Significance of the Design Value

Why is it important to gauge ambient air quality accurately? The 1990 CAAA established five categories of ozone nonattainment: marginal, moderate, serious, severe, and extreme. Each area's design value determines its classification.

A nonattainment area's classification defines its required attainment date and minimum requirements for its pollution abatement plan. Areas with high design values face more stringent control and planning prescriptions than locations with relatively low values. The length of time allowed for final compliance lengthens, however, as the design value rises. A moderate area, for example, must achieve compliance within six years of being designated as nonattainment while a serious area, having a higher design value, has nine years to meet the standard.

Congress also specified the consequences for failing to reach the law's air-quality target. If a nonattainment area's design value remains above the 0.12 ppm threshold as of the applicable deadline, its nonattainment status will automatically bump up to the next higher classification, requiring more stringent emissions control measures. Initially exempt from the bump-up provision, severe areas that fail to meet their deadline must implement an excess emission fee program for major sources of ozone-forming pollutants.

The Design Value's Dual Purpose

As just described, the 1990 CAAA directly links the design value with the development of an area's emissions-abatement plan. Consequently, the present design value has a dual purpose: not only does it establish the stringency of an area's mandated emissions-control program but it also helps define whether or not an area complies with the health-based standard. David Fairley, a statistician with the Bay Area Air Quality Management District, and Charles Blanchard, an independent consultant specializing in air-pollution issues, suggest that the two functions of the design value clash: "[H]ealth concerns and regulatory concerns conflict. Regulators try to improve air quality by controlling emissions. To utilize ambient ozone data to measure progress and success requires smoothing out or adjusting for confounding factors, such as daily meteorology. But the intent of the standard is to regulate actual (i.e., unadjusted, unsmoothed) ozone, because this is what people are actually exposed to."

Resolving that conflict is difficult because, unlike other air pollutants, smog is not emitted directly into the air, but is formed through complex chemical reactions between emissions of volatile organic compounds (VOCs) and nitrogen oxides (NOx), known as precursor emissions. That process is extremely dependent on the presence of sunlight and elevated temperatures, factors that tend to be highly variable. Wind patterns also influence the prevailing level of ozone. Therefore, as Fairley and Blanchard mention, fluctuations in weather make it difficult to draw conclusions about the effectiveness of ozone-control strategies. Either changing weather or varying levels of precursor emissions (or, most likely, a combination of both), can account for shifts in ozone concentrations.

Consequently, fashioning a well-tailored emissions-abatement strategy is tricky without adjusting for meteorology.

In setting the original health-based standard, though, Congress paid little attention to the erratic nature of ozone formation. The EPA was charged with protecting the public against adverse health effects resulting from exposure to ozone in the surrounding (ambient) air. Intent on limiting such exposures, the EPA adopted a maximum one-hour-average threshold concentration of 0.12 ppm. The EPA has attempted to remedy the conflict between the need to stabilize year-to-year data for emissions-control purposes and the need to protect public health from actual peak ozone levels.

Its compromise is to average the number of exceedances that a monitor registers over a three-year period. The agency's design-value study, however, confirms that the variability of weather conditions continues to be a problem. The draft report states: "Meteorology has been found to account for as much as 60-80 percent of the variance in daily maximum ozone concentrations at many locations in the eastern and midwestern U.S. and in California coastal cities."

Although the EPA says in its draft report that regulators are investigating methods for adjusting the design value for meteorological influences and that such adaptations are technically feasible, the agency stops short of fully endorsing such a change. Adopting a meteorologically adjusted design value would represent a "major departure from current EPA policy," the Agency explains, and is beyond the scope of the design-value study.

1988 Data Heat Up the Debate

Much of the dispute over the adequacy of the present design value centers around the costly requirements triggered by the use of ozone data from 1988. The summer of 1988 was the third hottest on record (dating back to 1895) in the United States, and had more favorable days for ozone formation than any other summer in the past 25 years. In November of 1991, EPA classified 98 nonattainment areas based on data that included readings from 1988, and as a result, the number of nonattainment areas rose by 37 cities. EPA listed a large portion (74) of the nonattainment areas as either marginal or moderate, 14 as serious, and nine as severe. The only extreme nonattainment area, Los Angeles, has by far the worst ozone problem in the United States.

Since its initial listing, EPA has officially redesignated four areas as attainment—Greensboro-Winston Salem-High Point (NC), Kansas City (KS-MO), Knoxville (TN), and Cherokee County (SC). In its design-value study, EPA reports that, if data from the three-year period 1990-92 were used to determine compliance, 42 of the remaining 94 nonattainment areas would meet the national standard.

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The EPA explains that year-to-year variations in weather played a critical role in improving ozone levels. Tighter limits on gasoline volatility and the replacement of older, high-polluting cars also helped lower concentrations. When similar information was released by the Bush administration, the Sierra Club, one of the largest and most influential environmental groups, criticized the EPA and the administration for taking credit for those reported improvements in air quality. They said that the figures indicate cleaner air quality because readings from 1988 were not considered in the most recent three years of data. That is true, but it doesn't clear up the controversy over the appropriateness of an ozone-control strategy that attaches so much significance to an unusual meteorological period such as 1988.

According to K. H. Jones, a former senior adviser on air quality to the President's Council on Environmental Quality during the Ford and Carter administrations, improvements are even greater than EPA's analysis indicates. Table 1, compiled by Jones, shows that only 26 urban

Table 1

Classification of Nonattainment Areas Outside of California

	Classification				
Case	Marginal	Moderate	Serious	Severe	Total
I 88/89/90 Data	42	29	12	6	89
II 89/90/91 Data	18	15	3	1	37
III 90/91/92 Data	17	17	0	1(1)	35
IV Case III Without Double Counting of Common Regions(3)	11(2)	14	0	1	26

(1) Houston's classification drops from Severe 17 to Severe 15.

(2) Two of these areas have design values of 0.124 ppm.

(3) Jones contends that EPA is guilty of double counting nine nonattainment areas. These areas, he says, are part of other nonattainment regions because their ozone problems are caused by emissions generated in larger neighboring urban areas. Jones concludes that EPA is subjecting these nine areas to pointless regulatory mandates.

Source: K. H. Jones, President of Zephyr Consulting (Seattle, Wash.), January 27, 1993.

areas outside of California would be designated as nonattainment using the most recent monitor readings and properly defining ozone air sheds. Except for Houston, no other location outside of California would be classified as serious or severe. Jones omits the nine current nonattainment areas in California from his analysis for two reasons: (1) ozone formation in Southern California differs from the rest of the country; and (2) California has established its own ozone standard that is more stringent than the rest of the nation's.

Reclassifying Nonattainment Areas

Despite the findings in Table 1, the law limits the EPA's discretion to redesignate or reclassify the remaining nonattainment areas. As spelled out in the 1990 CAAA, the EPA may not redesignate a nonattainment area to attainment unless:

- The area has attained the NAAQS, meaning it must have had no more than three exceedances in the previous three-year period;
- The EPA has fully approved the state's State Implementation Plan (SIP). (The 1990 CAAA requires each state which contains a nonattainment area to submit an amended SIP that explains, in detail, the steps that the violating areas will take to reach compliance);
- The EPA determines that the improvement in air quality is due to "permanent" and "enforceable" reductions in emissions;
- The area has a fully approved maintenance plan, ensuring continued attainment of the standard for at least 10 years after the area is redesignated; and
- The area has fulfilled all of the 1990 CAAA's regulatory and planning requirements applicable to its classification.

As mentioned previously, only four nonattainment areas have fulfilled all of those requirements.

Most of the 26 areas that would still be designated nonattainment, using Jones's definition of an area and the most recent monitoring data, have realized significant improvements. Those improvements are due almost entirely to more favorable weather and decreased auto emissions, according to the EPA. But the 1990 CAAA does not allow the EPA to reclassify an area downward from, say, severe to marginal. Therefore, an area such as Baltimore, Maryland, which has been classified as severe, but using 1990-92 data would be classified as marginal, must fully implement all of the regulatory and planning controls specified for the severe category.

At first glance, that seems sensible. If an area experienced severe ozone concentrations once, comparable ozone levels could reoccur if similar weather conditions were to arise. According to that reasoning such a nonattainment area still should be required to construct sufficient safeguards to fully protect public health against potential future exposures.

The notion, however, that the EPA should not reclassify nonattainment areas because a year like 1988 could happen again raises some interesting public-policy questions. For instance, for regulatory purposes, should an area be classified based on its worst air quality (i.e., peak ozone concentrations) or should the EPA mandate controls based on an area's typical air quality? More fundamentally, should Congress protect public health against relatively improbable events, like a repeat of 1988 ozone levels, regardless of the costs of doing so?

K. H. Jones, who authored the chapter on air-quality status and trends in eight Council on Environmental Quality annual reports, offers an insightful analogy of attempting to prevent all potential floods along the Mississippi. The likelihood of a flood occurring can be described as a once in 10-, 50-, or 100-years event depending on its severity, but it is theoretically impossible to build a flood-control project along the Mississippi to prevent all possible floods. (The great flood of 1993 bears grim testimony to the truth of this statement.) Similarly, Jones concludes, "It is not possible to reduce existing emissions to a point where there would be no more than one day above the ozone standard in another year exactly like 1988." The probability of a year such as 1988 occurring again is very low, says Jones. He estimates that the United States will likely experience a similar summer only once in the next 25 to 50 years.

Cost-Saving Opportunity

By simply not using 1988 data for classification purposes (i.e., using data that is more representative of average weather conditions), the EPA could reduce the regulatory burden of many cities. For example, the 1990 CAAA requires that serious, severe, and extreme nonattainment areas begin implementing an enhanced automobile inspection and maintenance (I&M) program in July 1994. According to Jones's data, car owners in 17 areas outside of California, including Chicago, Baltimore, Philadelphia, and Washington, D.C., will be required to pay those added costs even though current air quality appears to no longer justify the expense. Also, all metropolitan areas with populations of more than 100,000 in the Northeast would be exempt from the enhanced I&M program if the air shed that runs from Maine to Washington, D.C., was reclassified based on recent ozone data.

The EPA estimates that the enhanced inspection equipment costs approximately $140,000 per unit. Some testing stations may have to purchase several of those systems to accommodate the volume of customers. The *Washington Post* reported that, according to EPA officials, the enhanced test "may flunk up to a third of recent model cars at first, compared with today's 8 percent to 10 percent" failure rate. The *Post* also stated that "Owners will have to spend up to $450 in repairs (compared with the current U.S. average of $50 to $75) before they can obtain a waiver."

The EPA's recently released final guidance on its trip reduction program estimates that employers nationwide will spend $1.2 billion to $1.4 billion to comply.

Milwaukee, New York, Baltimore, Philadelphia, and Chicago could avoid the costs of implementing the 1990 CAAA's Employer Trip Reduction Program if 1988 data were not included in the three-year monitoring period. The trip reduction requirement forces businesses, institutions, and government agencies with more than 100 employees to increase average passenger occupancy per vehicle in commuting trips during peak travel periods by at least 25 percent above a predetermined areawide occupancy rate. In the Chicago area alone, this regulation will affect as many as 5,400 employers with 2 million employees.

The Chicago Area Transportation Study Task Force has estimated that employers may have to spend $77 million to $300 million to promote and subsidize those reduction plans. The EPA's recently released final guidance on that rule estimates that employers nationwide will spend $1.2 billion to $1.4 billion to comply.

Reclassifying those areas based on 1989-91 or 1990-92 data would alleviate the most obvious problem of using 1988 data in the baseline period for control strategies. Nevertheless, the design value would remain susceptible to future aberrant meteorological periods that could cause areas with nearly no ozone problems to be classified as nonattainment. Further, because the 1990 CAAA penalizes an area that fails to meet the standard by its prescribed deadline, any near-term aberrant meteorological conditions could boost a nonattainment area into the next higher category, requiring it to implement more stringent, and costly, controls.

Focusing on Extreme Values

Air-quality experts nearly universally recognize that the fourth-highest one-hour monitor reading in three years is a statistic that is biased towards describing an area's worst air quality, and varies randomly with the influence of weather. That feature may seem acceptable for indicating when an area has violated the health-based standard, but it is an inadequate reference value for prescribing emissions controls.

The most desirable design value would provide information about both peak ozone concentrations and average ozone levels in the area. In statistical jargon, such a measure would be more "robust" than the present design value.

The premise underlying the creation of separate categories of nonattainment with corresponding control requirements is that areas with similar design values have similar air-quality problems. Other measures of trends in ozone levels can differ greatly from peak values, however. As a consequence, determining the appropriate level of emissions controls needed to lower ambient ozone concentrations is extremely difficult.

The lack of conformity between peak ozone concentrations and typical air quality can be illustrated by comparing differences in the number of exceedances in areas with similar design values. For example, Pittsburgh and Louisville had identical design values for the 1987-89 period, qualifying them both as moderate nonattainment areas. Pittsburgh, however, violated the standard an average of 7.0 days a year during this three-year period while Louisville only averaged 1.5 exceedances a year. Washington, D.C., and Providence, Rhode Island, were classified as serious nonattainment areas using 1987-89 data and were relatively comparable with average annual exceedances of 5.0 and 6.4, respectively. On the other hand, California's San Joaquin Valley, also a serious nonattainment area, averaged 44.2 exceedances a year during this same period. In this same classification and time frame, Sacramento, California, had 15.8 exceedances a year.

Although it appears that the typical ozone problems in those areas differ, the 1990 CAAA requires areas in the same nonattainment classification to implement analogous minimum emissions control strategies. The average number of exceedances in an area has no bearing on the stringency of controls prescribed by the 1990 CAAA.

Alternative Design-Value Statistics

Using alternative statistics can better match an area's true air-quality problem to the stringency of its required control strategy. One possibility would be to retain the concentration-based approach, but average all of the available one-hour monitor readings for each nonattainment area. The advantages of using this statistic are its stability and representativeness. The magnitude of every reading, whether high or low, affects this average value and, thus, low measures lessen the impact of extreme concentrations on the statistic. This less erratic measure has the added advantage of improving an area's ability to track its progress towards compliance. Such an average concentration value is unacceptable to regulators, however, because it bears little relation to the peak concentrations.

The most desirable design value, therefore, would provide information about both peak ozone concentrations and average ozone levels in an area. In statistical jargon, such a measure would be more "robust" than the present design value. A more robust statistic would better describe typical or average ozone levels. For classification purposes, this feature would mitigate at least some of the natural variability of the ozone levels.

Fairley and Blanchard have suggested that ozone levels vary so much that the EPA should abandon a concentration-based standard altogether and adopt a compliance test based solely on the frequency of yearly exceedances. Although accounting for the number of incidences of elevated levels

Table 2

Comparing Concentration Measures

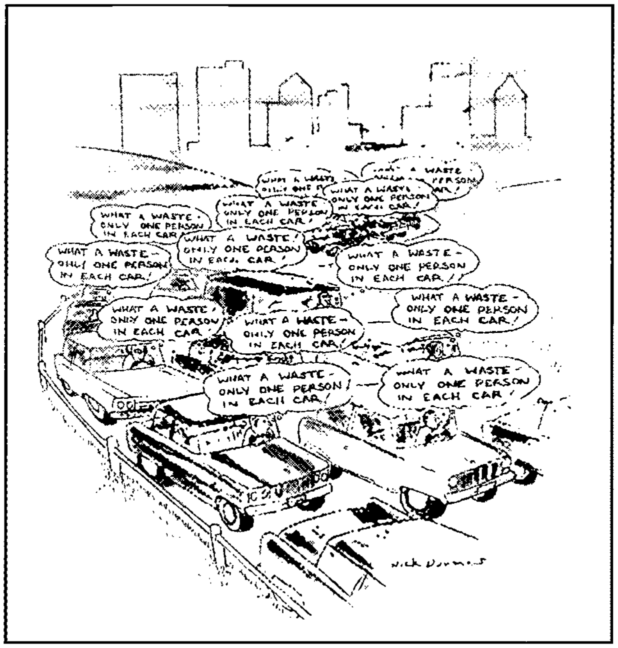
Nonattainment Area	Official Classification	1989 Design Value	Rank	Annual Average 95% Daily Max.	Rank	Annual Average Top 30 Daily Max.	Rank
Los Angeles-SCAB, CA	Extreme	0.330	1	0.267	1	0.221	1
Houston-Galveston-Brazoria, TX	Severe-17	0.220	2	0.113	9	0.090	11
New York,-N. New Jersey-Long Is., NY-NJ-CT	Severe-17	0.201	3	0.154	2	0.120	3
Baltimore, MD	Severe-15	0.194	4	0.138	4	0.114	4
Philadelphia-Wilmington-Trent, PA-NJ-DE-MD	Severe-15	0.187	5	0.128	7	0.107	6
Greater Connecticut	Serious	0.172	6	0.134	6	0.107	6
Ventura County, CA	Severe-15	0.170	7	0.143	3	0.127	2
Baton Rouge, LA	Serious	0.164	8	0.105	13	0.082	13
Beaumont-Port Arthur, TX	Serious	0.160	9	0.093	15	0.078	15
Sacramento Metro, CA	Serious	0.160	9	0.137	5	0.113	5
Charlotte-Gastonia, NC	Moderate	0.158	11	0.111	10	0.096	9
Knox & Lincoln Cos., ME	Moderate	0.158	11	0.109	11	0.081	14
Louisville, KY-IN	Moderate	0.149	13	0.098	14	0.087	12
Pittsburgh-Beaver Valley, PA	Moderate	0.149	13	0.115	8	0.098	8
Salt Lake City, UT	Moderate	0.143	15	0.108	12	0.092	10

Sources: The 1989 design values and classifications are from *Ozone and Carbon Monoxide Areas Designated Nonattainment* (Research Triangle, Park, N.C.: EPA, Office of Air Quality, Planning, and Standards, October 26, 1991). Data for the "95% Daily Max" and "Top 30 Daily Max" provided by the Center for Air Pollution and Trend Analysis, Washington University, St. Louis, MO.

of ozone seems intuitively appealing and merits further consideration, such a wholesale restructuring of the design value is unlikely in the short term.

Table 2 compares different concentration measures for a sample of 15 nonattainment areas. This table shows how the current design value is inconsistent with other statistics that could be used to better describe typical ozone concentrations.

Each of the statistics in Table 2 includes data from 1987-89. The second column in the table shows the 1989 design value for each of the 15 nonattainment areas selected. It is this value that EPA used to determine the current nonattainment classification for those areas. The "Average 95 percent Daily Max," a more descriptive measure than the design value, is a percentile statistic. Five percent of the daily maximum readings in one year are greater than the Average 95 percent Daily Max value. An even



more descriptive measure is the "Top 30 Daily Max." This value is the average of the 30 highest daily one-hour monitor readings in a year. Those latter two annual statistics are actually averaged over the three-year period 1987-89. Air-quality experts tend to agree that a rolling three-year average reduces the effects of year-to-year fluctuations in the data, yet also adequately measures current conditions.

Under the current methodology, many cities have been, and will continue to be, required to make greater economic sacrifices than appear warranted if other measures of air quality were used.

Ranking the various nonattainment areas using those different statistics yields some interesting results. For instance, Los Angeles has far and away the worst ozone air quality regardless of the statistic used. Readings in New York, Baltimore, and Greater Connecticut, although substantially lower than those recorded in Los Angeles, also maintain their high ranking regardless of the measure used.

The relative ranking of some of the nonattainment areas, however, varies considerably depending upon which statistic is used. Sacramento, for example, has the ninth worst 1989 design value, but the fifth worst air quality using the more descriptive 95 percent Daily Max or the Top-30 statistics. The ranking of Ventura County ascends from seventh to third and finally to second as the measuring method becomes more robust. In short, while those two California areas have peak values lower than other serious and severe areas included in Table 2, their typical ozone levels are relatively higher than most of the non-California areas in this table.

By contrast, residents of Houston might assume that their air quality is poor based on the area's 1989 design value. Under the Top-30 measure, however, Houston is one of the cleanest areas in the sample. In fact, it ranks below Salt Lake City, which has the lowest 1989 design value of the five moderate areas listed in the table. Similarly, under the Top 30 statistic, Beaumont/Port Arthur, Texas, currently classified as serious, would rank fifteenth, below all five of the areas in the table that EPA now classifies as moderate.

Technical Complications

A host of technical problems would arise if the EPA were to adopt a more robust standard such as the two alternatives presented in Table 2. The most important such problem would be equivalency. EPA officials set the level of the ozone standard at 0.12 ppm because they felt that this threshold adequately protects public health and environmental quality. In order to be politically viable, any change in the form of the standard could not come at the expense of health and environmental protection. According to this line of reasoning, if the standard were made more robust, the concentration threshold would have to be revised downward to retain the same level of health protection.

In addition, weather influences even robust indicators, albeit to a lesser degree than the current design value. Therefore, using a more robust indicator and revising the threshold downward would not keep areas near compliance from bouncing into and out of attainment. To solve that problem, David Chock, a chemical physicist and environmental policy analyst at Ford Motor Company, has proposed instituting a statistical compliance test that would establish a so-called "confidence interval," which is simply a range within which an area's design value must fall in order for it to be designated attainment. According to David Chock and his colleague Jon Heuss (an environmental policy analyst at General Motors), introducing an interval as the target for compliance is consistent with our ability to predict and control fluctuations in ozone levels. Further, Heuss states: "The stringency of this test could be varied depending on attainment status. That is, the test can be stringent for areas to demonstrate attainment, but relaxed somewhat for areas already in attainment. The result would be to dampen the impact of, for example, a hot summer like 1988 converting attainment areas to nonattainment."

Although unraveling the technical details of adopting a new standard would undoubtedly be a formidable task, the need for revision is clear. Adopting a more robust standard would allow regulators to better match control strategies with an area's typical air quality.

As Congress and the EPA consider the prospect of revamping the design value, they should not lose sight of the broader public policy issues. In particular, Congress should revisit the question of whether stringently controlling peak ozone levels produces commensurate health and environmental benefits. The Clean Air Act currently does not allow for considering costs when setting national ambient air-quality standards. As a result, not many estimates of the costs and benefits of achieving improvements in urban smog have been offered.

During the debate preceding the passage of the 1990 CAAA, however, the Center for the Study of American Business published a comparison of the estimated costs and benefits of reducing ozone-producing pollutants by 40 percent. At the time of that analysis, Congress's Office of Technology Assessment (OTA) also offered cost estimates for a 35 percent reduction in VOCs. The OTA projected that a 35 percent decrease in VOC emissions would bring one-third of the 94 areas that were in mild violation of the ozone standard in 1985 into compliance by 2004.

Using cost and efficiency data from the EPA, the OTA, and Alliance Technology Corporation, and benefit data from a Resources for the Future study conducted for the OTA, researchers at the Center for the Study of American Business computed cost-to-benefit ratios. The analysis showed that, as a result of the 1990 CAAA, taxpayers and consumers will be forced to pay between \$3.30 and \$4.90 for each \$1 worth of health-related benefits from the new ozone control measures.

Nonetheless, the language of the Clean Air Act requires that the ozone standard provide an "adequate margin of safety" against "any adverse health effect," regardless of cost. That lofty objective has been described by William Ruckelshaus, a two-time EPA administrator, as an unattainable "standard of perfection." Ultimately, this high-cost pursuit of perfection cannot be avoided unless Congress revises the fundamental objectives of the Clean Air Act. The Act's standard should address unreasonable risks of significant adverse health effects and allow for consideration of costs and benefits in setting protection levels.

Conclusion

The significance of the design value substantially increased when Congress amended the Clean Air Act in 1990. That statistic is now used to define the severity of a nonattainment area's ozone problem. In its present form, however, the design value depends too heavily on extreme values to effectively represent the typical air quality of many nonattainment areas.

The EPA's draft report concludes that the design value "provides a reasonable estimate of peak levels within the urban areas, and the degree of nonattainment of the area." As for being a representative measure of the true air quality of an area, however, the current ozone design value falls short. EPA's draft study cites spatial variability and weather fluctuation as confounding factors.

Under the current methodology, many cities have been, and will continue to be, required to make greater economic sacrifices than appear warranted if other measures of air quality were used. At a minimum, EPA could alleviate much of the needless regulatory burden many urban areas now face by asking Congress to allow the agency to reclassify nonattainment areas based on data that exclude the aberrant 1988 readings. More fundamentally, Congress should muster the political courage to revise the Clean Air Act's smog measure so that scarce public and private resources can be allocated where they will provide greater public good.