MERCATUS CENTER
GEORGE MASON UNIVERSITY

REGULATORY STUDIES PROGRAM

Public Interest Comment on
Proposed Rule to Implement the 8-Hour Ozone National Ambient Air Quality Standard[1]

The Regulatory Studies Program (RSP) of the Mercatus Center at George Mason University is dedicated to advancing knowledge of the impact of regulation on society. As part of its mission, RSP conducts careful and independent analyses employing contemporary scientific and economic scholarship to assess rulemaking proposals from the perspective of the public interest. Thus, this comment on the EPA Proposed Rule to Implement the 8-Hour Ozone National Ambient Air Quality Standard does not represent the views of any particular affected party or special interest group, but is designed to evaluate the effect of the Agency's proposals on overall consumer welfare.

I. Introduction and Background

The Clean Air Act (CAA) gives the Environmental Protection Agency (EPA) the authority to periodically revise the National Ambient Air Quality Standard (NAAQS), and to require non-attainment areas to produce and implement state implementation plans (SIPs) demonstrating enforceable commitments to reduce emissions sufficiently to attain the NAAQS by required deadlines. In 1997, EPA promulgated a more stringent NAAQS for ozone, commonly known as the 8-hour ozone standard.[2] EPA plans to designate areas as attainment or non-attainment under the 8-hour ozone standard by April 15, 2004.[3] This Public Interest Comment assesses EPA's proposed rule to implement the 8-hour ozone standard.[4]

---

[1] Prepared by Joel Schwartz, Adjunct Scholar, Mercatus Center at George Mason University (jschwartz@pacbell.net). This comment is one in a series of Public Interest Comments from Mercatus Center's Regulatory Studies Program and does not represent an official position of George Mason University.

[2] EPA, " National Ambient Air Quality Standards for Ozone: Final Rule," *Federal Register*, July 18,1997, p. 38855-96.

[3] As EPA agreed in a consent decree, *American Lung Association v. Whitman,* D.D.C., No. 03-778, May 19, 2003.

[4] EPA, "Proposed Rule to Implement 8-Hour Ozone National Ambient Air Quality Standard," *Federal Register*, June 2, 2003, p. 32802-70,

A. Legal Challenges to the 8-hour Ozone Standard

Although EPA promulgated the 8-hour standard in 1997, legal challenges kept the standard in limbo until March 2002. The Supreme Court ruled on the case in February 2001, but remanded some issues back to the Court of Appeals for the D.C. Circuit.[5] The major questions before the Supreme Court included:

- Whether the EPA may consider implementation costs in promulgating a NAAQS. EPA argued it could not consider costs and the Supreme Court agreed.

- Whether Section 109(b) of the Clean Air Act (CAA), requiring the EPA administrator to set NAAQS to protect public health with an adequate margin is safety, constitutes an unconstitutional delegation of legislative power. The Court held that it did not.

- Whether EPA's interpretation of Title I, Part D of the CAA was unreasonable. Part D lists State Implementation Plan (SIP) requirements for air pollution non-attainment areas. Subpart 1 includes relatively general requirements for SIPs, while Subpart 2 is more stringent and prescriptive. EPA planned to implement the 8-hour NAAQS solely under Subpart 1. The Court held that EPA had some discretion in determining the roles for Subparts 1 and 2 in implementing the NAAQS, but that EPA's chosen approach, which provided no role at all for Subpart 2, was unreasonable.

On March 26, 2002 the Court of Appeals for the D.C. Circuit rejected all remaining challenges to the 8-hour ozone standard and EPA began to develop an implementation rule for the standard.

B. Current and New Ozone Standards

EPA's current ozone standard is known as the 1-hour standard. Promulgated in 1979, the 1-hour standard requires that ozone not exceed 125 parts per billion (ppb) on more than an average of one day per year.[6] Ozone levels are measured as the highest daily 1-hour-average ozone level, hence the name of the standard. The most recent three years of ozone monitoring data are used to determine attainment of the standard.

---

http://cascade.epa.gov/RightSite/getcontent/Tempfile.pdf?DMW_OBJECTID=090007d48016b1c1&DMW_FORMAT=pdf.

[5] The initial case was argued in the D.C. Circuit court of appeals, American Trucking Associations, Inc. v. EPA, 175 F.3d4 (D.C. Circuit, May 14, 1999), http://pacer.cadc.uscourts.gov/common/opinions/199905/97-1440a.txt. The Supreme Court's opinion is 531 U.S. __(2001), http://supct.law.cornell.edu/supct/pdf/99-1257P.ZO. The remaining issues remanded back to the D.C. Circuit Court of Appeal were decided in American Trucking Associations, Inc. v. EPA, 283, F.3d 355 (D.C. Circuit, March 26, 2002), http://pacer.cadc.uscourts.gov/common/opinions/200203/97-1440c.txt.

[6] EPA, *Federal Register*, February 8, 1979, p. 8202

The 8-hour standard is more stringent and is also formulated differently. Attainment of the 8-hour standard is determined as follows: For each ozone monitoring site, take the fourth-highest daily ozone reading from each of the last three years, and average those three values. To attain the standard, the resulting value must not exceed 85 ppb. Daily ozone levels are determined based on the highest 8-hour-average ozone reading. Although the correspondence is not exact, the 1-hour standard is roughly equivalent to an 8-hour standard set at about 95 ppb.[7] The areas of the country with the worst ozone levels—parts of the greater San Bernardino, Fresno, and Bakersfield areas in California—currently exceed the 125 ppb, 1-hour ozone benchmark about 15-30 times per year, and the 85 ppb, 8-hour benchmark about 60-80 times per year.[8]

The 8-hour standard is significantly more stringent than the 1-hour standard. Based on national ozone monitoring data for 1999-2001, about 13 percent of the nation's monitoring locations exceed the 1-hour standard, while about 40 percent exceed the 8-hour standard.[9] Implementing the 8-hour standard will result in many 1-hour ozone attainment areas being reclassified as non-attainment based on the 8-hour standard.

C. Ozone Formation and Precursors

Ozone is not directly emitted, but is formed when nitrogen oxides (NOx) and volatile organic compounds (VOC) react with oxygen and hydroxyl radicals in the presence of sunlight. Carbon monoxide (CO) also contributes to ozone formation, fulfilling a role similar to VOCs. Since CO is much less reactive than typical VOCs, a molecule of CO generates less ozone than a molecule of VOC. However, since total CO emissions are several times greater than VOC emissions, CO still accounts for as much as 10 to 20 percent of ozone formation in metropolitan areas. The highest ozone levels generally occur on hot days with relatively stagnant air.

Automobiles, diesel trucks, and coal-fired power plants together account for about three-quarters of NOx emissions, while gasoline vehicles alone contribute 50 to 75 percent of anthropogenic VOC.[10] Natural VOC from vegetation is also a major contributor to total VOC emissions in some areas, particularly in the more lush eastern half of the United States.[11] These "biogenic" VOCs even account for the vast majority of VOC emissions in some areas, such as Atlanta. Almost all CO emissions in metropolitan areas come from

[7] Based on conversion estimates in J. I. Levy et al., "Assessing the Public Health Benefits of Reduced Ozone Concentrations," *Environmental Health Perspectives*, vol. 12 (2001), pp. 9-20.

[8] Author's analysis of ozone data downloaded from EPA's AirData website, www.epa.gov/aqspubl1/select.html.

[9] Ibid.

[10] See below for a more detailed discussion of emissions inventory issues.

[11] See, for example, P. Solomon et al., "Comparison of Scientific Findings from Major Ozone Field Studies in North America and Europe," *Atmospheric Environment*, vol. 34 (2000), pp. 1885-1920.

gasoline vehicles, with a small amount also contributed by diesel vehicles and industrial emissions.[12]

D. Non-Attainment and State Implementation Plans

The CAA requires areas designated as non-attainment areas for one or more NAAQS to develop a SIP showing how the area will progress toward and eventually attain the NAAQS by specified deadlines. A SIP generally includes (1) a baseline inventory of emissions from all known pollution sources in a given area, (2) a target maximum emissions level, estimated through modeling, that the area must reach in order to attain a given NAAQS, and (3) a schedule of pollution control measures that the area commits to implement in order to meet CAA progress requirements and eventually attain the health standard. Although the CAA requires areas to attain NAAQS by certain ultimate deadlines, the Act also requires areas to reach attainment as expeditiously as possible, regardless of the area's nominal deadline. EPA's proposed rule for implementing the 8-hour NAAQS is mainly concerned with how the CAA's existing legal and regulatory structures will apply to areas in non-attainment of the 8-hour standard.

II. Summary of the Proposed Rule

EPA's proposed rule for implementing the 8-hour ozone standard is actually a proposal for a proposed rule. EPA has not yet proposed formal regulatory language, but instead has laid out a series of options it is considering for inclusion in what will ultimately be the proposed rule.

A. Classification of Areas

An area's ozone non-attainment classification determines the extent and stringency of measures that must be included in the area's SIP. Section 181 of the CAA requires that 1-hour ozone non-attainment areas be classified as marginal, moderate, serious, severe, or extreme based on their 1-hour ozone "design value"—that is, the fourth highest 1-hour ozone reading during the last three years at the ozone monitoring location with the highest ozone level in the area. The first two columns of Table 1 display the relationship between 1-hour ozone non-attainment classification and 1-hour ozone design value, as explicitly defined in the text of the CAA.

In order to develop an equivalent classification scheme for 8-hour ozone non-attainment areas, EPA "translated" the 1-hour ranges into equivalent 8-hour ranges. To do this, EPA created 8-hour classification ranges that are in the same ratio to the 80 ppb 8-hour ozone attainment level, as the 1-hour standard ranges are to the 120 ppb 1-hour attainment level.[13] The 8-hour design value for an area is the most recent three-year average of the

[12] EPA, "Latest Findings on National Air Quality: 2000 Status and Trends," EPA 454/K-01-002, September 2001, www.epa.gov/oar/aqtrnd00/brochure/00brochure.pdf.

[13] Note that when determining actual non-attainment, although the 1-hour standard is nominally set at 120 ppb, in reality 125 ppb is the actual non-attainment level. The reason is that ozone is measured to the

fourth-highest 8-hour ozone reading from each year at the monitoring location that gives the highest value.

The third and fourth columns in Table 1 display the translated 8-hour classifications along with the time allotted (from the date of designation) to attain the standard for each non-attainment classification. The fifth column displays the number of metropolitan areas EPA estimates would fall into each 8-hour non-attainment category out of 122 total areas. EPA calls these "hypothetical areas," because the 8-hour areas will not necessarily have the same geographic definition as the current 1-hour areas. Based on these 122 hypothetical areas that exceed that 8-hour standard, 85 (70 percent) attain the 1-hour standard.

EPA is evaluating two options for classifying areas under the 8-hour standard, and has not yet decided which option it will ultimately choose.

Option 1. Non-attainment areas would be classified under Subpart 2 of Part D of Title I of the CAA. Under subpart 2, which is the authority under which EPA currently classifies 1-hour ozone non-attainment areas, areas receive one of the classifications in Table 1. The type of classification determines both the extent and stringency of the measures required to reach attainment, and the date by which attainment must be achieved. Under this option, the legal and regulatory framework for progressing toward attainment would be similar to the current system.

Table 1. Clean Air Act Classifications and Deadlines for Areas Classified Non-Attainment Under Subpart 2

Non-Attainment Classification	1-hour Ozone Design Value Specified in CAA (ppb)	"Translated" 8-hour Ozone Design Value (ppb)	Years to Attain Standard After Designation	Estimated Number of Areas
Marginal	121-138	85-92	3	61
Moderate	138-160	92-107	6	53
Serious	160-180	107-120	9	6
Severe 15	180-190	120-127	15	1
Severe 17	190-280	127-187	17	1
Extreme	>280	>187	20	0

Option 2. Under this option, so-called gap areas—that is, those areas that exceed the 8-hour standard, but have 1-hour design values less than 121 ppb—would be classified

nearest ppb, and EPA rounds to the nearest 10 ppb in determining attainment. Thus, 124 ppb is rounded to 120 ppb. Similarly for the 8-hour standard, an area attains the standard if its design value is 84 ppb or less. Since 85 and 125 ppb are the standards for practical purposes, these are the values I will use when referring to the standards in the rest of this paper.

under Subpart 1 of Part D of Title I of the CAA, which is less stringent and less prescriptive than Subpart 2. For example, Subpart 2 includes the following requirements beyond Subpart 1:[14]

- A basic or enhanced inspection and maintenance (I/M) program
- Reformulated gasoline
- Reasonable further progress of at least 3 percent per year reduction in ozone precursors
- For each non-attainment classification, progressively lower threshold emission levels above which industrial pollution sources fall under the New Source Review (NSR) program
- Progressively higher NSR new-emissions offset ratios, based on an area's non-attainment classification
- Reasonably Available Control Technology (RACT) for NOx as well as VOC

EPA estimates that 76 out of the 122 areas would qualify to be classified under Subpart 1. All of these 76 areas would otherwise fall into the marginal or moderate categories under Subpart 2. According to EPA, 85 out of 122 8-hour non-attainment areas attain the 1-hour standard. This means that nine areas attain the 1-hour standard, but would still fall under a Subpart 2 non-attainment classification. These are areas with 1-hour ozone design values between 121 and 124 ppb.[15]

Areas designated under Subpart 1 would have five years to attain the 8-hour standard, with the option for an extension to 10 years, depending on the severity of the problem and the availability of "feasible" control measures.

EPA's intent with this two-tiered classification system is to provide more flexibility and reduce attainment costs for areas the are relatively close to attainment, and that EPA expects to attain the standards based on already adopted pollution control measures.

Incentives. EPA is also considering creating an "incentive feature" that could operate under either classification option. Under this feature, EPA would allow an area to qualify for a lower classification by demonstrating it will meet the attainment date of that lower classification. Under this incentive program, EPA estimates that under Option 1, 23 moderate areas would move to marginal; under Option 2, five of 26 moderate areas

[14] These are just a few of the Subpart 2 requirements. See Appendix A of EPA's proposed rule for a detailed table.

[15] EPA, *Background Information Document: Hypothetical Nonattainment Areas for Purposes of Understanding the EPA Proposed Rule for Implementing the 8-hour Ozone National Ambient Air Quality Standard; Illustrative Analysis Based on 1998-2000 Data, DRAFT* (Washington, DC: April 2003).

would move to marginal. Table 2 summarizes EPA's estimate of the number of areas in each classification under Options 1 and 2, with and without the incentive feature.

EPA has also created a way for areas to avoid an 8-hour non-attainment designation by proactively taking steps to reduce ozone precursors ahead of formal regulatory requirements. By entering into an enforceable "early action compact" (EAC) with EPA, an area that exceeds the 8-hour ozone standard can delay formal redesignation until 2007, giving the area three extra years to come into compliance before more formal and prescriptive CAA planning and implementation requirements come into force.

Table 2. Estimated Number of Areas Under Each CAA Non-Attainment Classification Under Options 1 and 2, and the Incentive Feature

	Subpart 2						Subpart 1	
	Extreme	Severe-17	Severe-15	Serious	Moderate	Marginal		Total
Option 1 (8-hour design value)	0	1	1	6	53	61	0	122
Option 1 (8-hour design value)–with incentive feature*	0	1	1	6	30	84	0	122
Option 2 (2-step approach—areas < 0.121 ppm = subpart 1)	0	1	1	6	26	12	76	122
Option 2 (2-step approach—areas < 0.121 ppm = subpart 1)–with incentive feature[1]	0	1	1	6	21	17	76	122

[1] Areas that would be moderate using their 8-hour design value but that are projected to attain by 2007 would be classified marginal.

Source: EPA, 68 FR 32802, June 3, 2003, at 32816

1. Areas with the Worst 8-Hour Ozone Problems

Table 3 lists the eight metropolitan areas that EPA projects would be classified serious or severe 8-hour non-attainment areas, based on 1998-2000 ozone monitoring data.[16] The two rightmost columns list, respectively, the 8-hour and 1-hour ozone design values for each area.

Four of the eight areas are in California, which has authority to go beyond federal air pollution control requirements and has the strictest air pollution control requirements in the nation. Federal regulatory actions can therefore be considered of less significance for California's progress on air pollution when compared with other areas of the United States.

[16] Ibid.

Table 3. EPA Projection of Metropolitan Areas that Would Be Classified Serious or Severe Under the 8-hour Ozone Standard, Based on 1998-2000 Ozone Monitoring Data

Ozone Non-Attainment Classification	Metropolitan Areas	8-hour Design Value (ppb)	1-hour Design Value (ppb)
	New York-Northern New Jersey-Long Island-Southern Connecticut	107	140
	Sacramento, CA	107	148
	Washington, DC-Baltimore-Northern Virginia	107	145
	San Joaquin Valley, CA	111	161
	Houston-Galveston-Brazoria, TX	112	199
	Southeast Desert, CA	113	164
Severe-15	Atlanta, GA	121	157
Severe-17	Los Angeles-Orange-San Bernardino-Riverside, CA (South Coast Air Basin)	146	211

EPA's projection is based on 1998-2000 ozone data. But 1998 and 1999 were years of uniquely high ozone levels in some parts of the country, particularly the southeast, when compared with other years during the 1990s and 2000s. The difference is particularly striking in the Atlanta area. Figure 1 displays the number of days per year that the highest-ozone areas of the Atlanta metro region exceeded the 8-hour, 85 ppb benchmark from 1993-2002.[17] Note the difference between 1998-1999 and other years.

Figure 2 compares ozone design values for seven of the eight hypothetical serious/severe areas based on 1998-2000 and 2000-2002 EPA 8-hour ozone monitoring data.[18] The two worst areas, Los Angeles and Atlanta, experienced substantial declines in their design values. Atlanta would move from severe down to moderate, while Sacramento and Washington, DC would just barely edge into the moderate category.

[17] EPA was not able to supply 8-hour ozone data going back before 1993.

[18] I left out the Southeast Desert Air Basin, because, due to its tortuous geography it would have been cumbersome to figure out which monitoring locations it contains*. Since it lies downwind of the South Coast Air Basin, it is probably reasonable to assume it behaved similarly to South Coast.

Of course it is also possible that some moderate areas experienced increases that would push them into the serious classification. Based on EPA's hypothetical areas analysis, there are eight moderate areas with 8-hour design values greater than 100 ppb. Of these, the design value decreased for seven areas—mainly areas in the southeast, following the same pattern as Atlanta, and also Ventura County, California. On the other hand, the Philadelphia-southern New Jersey area would bump up from moderate to serious.

Based on these results, as of the end of 2002 there would be one severe area (Los Angeles), and five serious areas. Three of these six areas are in California.

Figure 1. Number of Days per Year Three Atlanta-area Ozone Monitors Exceeded the 8-hour, 85 ppb Ozone Benchmark from 1993-2002

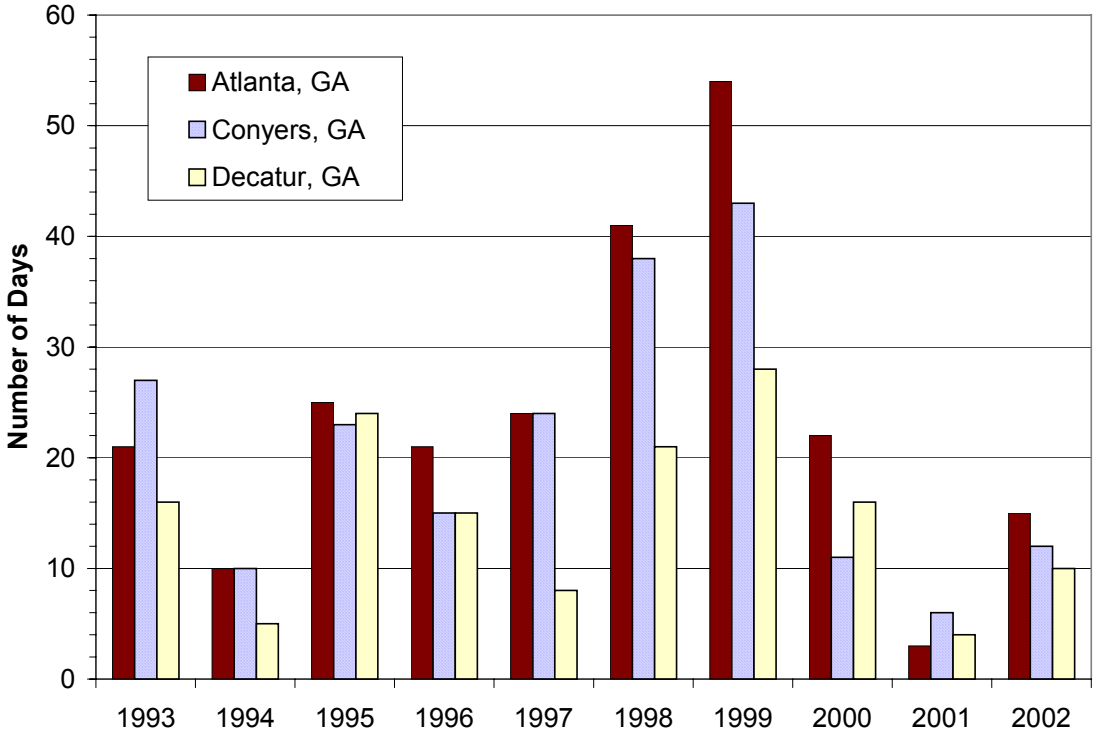
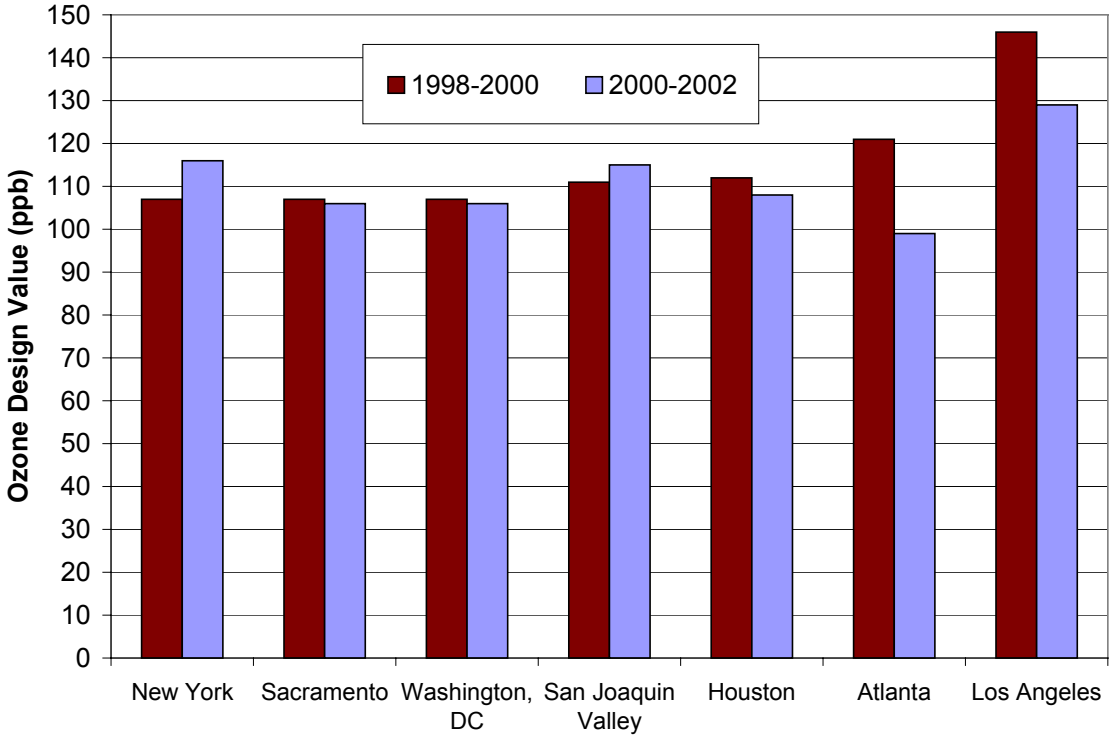


Figure 2. Change in Ozone Design Values Between 1998-2000 and 2000-2002 for Eight Areas Classified Serious or Severe Based on 1998-00 Data



B. Anti-Backsliding Provisions and the Transition from the 1-hour to the 8-hour Standard

EPA is proposing to either partially or completely revoke the 1-hour ozone standard one year after areas are designated under the 8-hour standard. EPA has established two goals in transitioning from the 1-hour to the 8-hour standard: (1) ensuring continued applicability of Subpart 2 requirements where they already exist, and (2) ensuring continued air quality improvement.

The CAA already contains a number of provisions intended to ensure continued progress toward attaining the NAAQS. EPA had to interpret these provisions in light of the transition from the 1-hour to 8-hour standard, which was not foreseen when the CAA was last amended in 1990. CAA anti-backsliding provisions include the following:

- Section 110(l) of the CAA prohibits EPA from approving a SIP revision if such revision would interfere with a region's progress toward attainment of a NAAQS.

- Section 193 of the CAA prohibits modification of a pollution control requirement in effect or required to be adopted as of November 15, 1990—the date the Clean Air Act Amendments of 1990 (CAAA) were adopted—unless such modification would achieve equal or greater emission reductions.

- Areas classified non-attainment prior to adoption of the CAAA cannot remove from their SIPs control measures specified in Subpart 2 of the CAA, even if they are redesignated to attainment. However, they can shift such measures to contingency status so that they would be promptly implemented if a violation occurred after redesignation.

Backsliding issues arise because some areas will receive a lesser designation under the 8-hour standard than their current designation under the 1-hour standard. EPA prefers the option of full revocation of the 1-hour standard one year after areas are designated under the 8-hour standard. Under this option, the 1-hour standard would disappear, but the anti-backsliding provisions would still apply. Under partial revocation, EPA would retain the 1-hour standard and associated classifications for limited anti-backsliding purposes until an area complies with the 1-hour standard.

C. Consequences of Failure to Attain

If a Subpart 2 area fails to attain the standard by the required deadline, the area must be bumped up to the next worst classification and adopt a revised attainment plan containing additional measures specified by the CAA for the new non-attainment designation.

If a Subpart 1 area fails to attain the standard by the required deadline, the area would be required to adopt a new plan demonstrating attainment and include in the plan any requirement mandated by the EPA Administrator.

D. Interstate Transport

If a given area is downwind of a pollution source, transport of ozone or its precursors from one jurisdiction to another can prevent that area from attaining the ozone standard through local measures alone. EPA in 1998 adopted regulations known as the NOx SIP Call and Section 126 Rule to address interstate transport of pollutants. These rules require a 60 percent reduction in NOx emissions from coal-fired power plants and industrial boilers in the eastern half of the United States. EPA intends these rules to mitigate transport concerns under the 8-hour standard.

E. Reasonable Further Progress Requirements

The CAA includes a requirement for "Reasonable Further Progress," or RFP. In practice, this means that moderate-and-above areas must achieve a 15 percent reduction in volatile organic compound (VOC) emissions during the first six years after designation, and a three-percent-per-year reduction thereafter, averaged over successive three-year periods. This requirement is generally referred to as a "rate of progress," or ROP requirement. EPA is proposing to calculate these requirements relative to a 2002 base year.

Under EPA's proposal, areas could meet the ROP requirement for the 8-hour standard by demonstrating in their SIPs a 15 percent VOC reduction between 2002 and 2008. Alternatively, EPA is proposing a second option whereby areas could meet this requirement by showing they had already reduced VOC emissions by 15 percent as part

of a 1-hour ozone attainment SIP. Serious-and-above areas meeting this criterion would still need to meet the additional three-percent-per year ROP requirement through VOC and/or NOx reductions, but could initially average the requirement over the period from 2002-2008 and then every three years thereafter. Moderate areas meeting this criterion would fall under the CAA's general RFP requirements. EPA has interpreted the general RFP requirement to mean that by the attainment date (that is, six years after designation) moderate areas' emissions must be below the emissions target specified in the SIP.

III. Policy Issues

A. Requiring Attainment of the 8-hour NAAQS will Cause Net Harm to Americans

Pollution reduction measures involve "health-health" tradeoffs for the public.[19] Reducing pollution may improve health. But regulations to reduce pollution make most goods and services more expensive, reducing families' disposable income. Because people on average use their income to make their lives safer—for example, by buying better and safer products, more nutritious food, better medical care, more leisure time, etc.—reducing peoples' disposable income reduces their health and welfare.

A number of researchers have attempted to estimate the health effects of regulatory costs. These estimates suggest that every $15 million in additional regulatory costs results in one additional induced fatality.[20] Expected health benefits of a regulation must be weighed against these health costs in order to increase the likelihood that a given regulation will provide net health benefits to the public.

EPA ignored the negative health effects of regulatory costs when promulgating the 8-hour ozone standard, and, as noted earlier, the Supreme Court ruled that EPA may not include implementation costs as a factor in determining the level at which the NAAQS are set.

---

[19] Randall Lutter and John Morrall appear to be the first to use this term. See, R. Lutter and J. F. Morrall, "Health-Health Analysis: A New Way to Evaluate Health and Safety Regulation," *Journal of Risk and Uncertainty*, vol. 8 (1994), pp. 43-66.

[20] R. Lutter et al., "The Cost-Per-Life-Saved Cutoff for Safety-Enhancing Regulations," *Economic Inquiry*, vol. 37, no. 4 (1999), pp. 599-608. Fifteen million dollars was their "best estimate," with a range of $10 million to $50 million.

Health-health analysis is only a partial analysis of the net welfare effects of a regulation, because such analyses currently include only mortality. Benefit-cost analyses attempt to include all costs and benefits of a regulation—not only mortality, but morbidity (that is, disease and disability), and all the other social-welfare effects of a regulation. In this sense, health-health analysis is a weaker test of the value of a regulation than benefit-cost analysis. However, because it is a weaker test, if a regulation can't be shown to have net health benefits in a health-health analysis, than it's very likely that the regulation in question will cause net harm to the public. Health-health analysis also has the virtue of making the net health effects of a regulation explicit to the public, while benefit-cost analysis is often perceived (inaccurately) as divorced from concerns over human welfare.

All estimates published to date, including EPA's own cost-benefit analysis for the 8-hour ozone standard, have concluded that requiring nationwide attainment of the 8-hour standard would cause net harm to the American public. EPA's Regulatory Impact Analysis for the 8-hour standard concluded "Quantifiable net benefits for full attainment of the ozone standard are estimated to range from negative $1.1 to negative $8.5 billion"—in other words, after accounting for the value of all expected health and welfare benefits and the estimated costs of attaining the standard, EPA concluded that attaining the 8-hour ozone standard nationwide would entail billions of dollars per year in net costs to the American public.[21]

The real situation is far worse than this for two reasons. First, 90 percent of the estimated health benefits are due to projected reductions in mortality. However, the link between current ozone levels and increased mortality is tenuous, suggesting that EPA's claimed mortality benefits might not materialize.[22] Other aspects of EPA's benefit assessment also indicate that, in real terms, the marginal health benefits of the 8-hour NAAQS would be modest at best. For example, EPA concluded that going from full national attainment of the 1-hour ozone NAAQS to full national attainment of the 8-hour ozone NAAQS would reduce emergency room visits for asthma by just 0.6 percent.[23] As EPA acknowledged, only a small fraction of all respiratory distress is due to air pollution in the first place, so reducing air pollution will have a small effect on overall respiratory morbidity.

Second, EPA made some unwarranted assumptions that caused it to substantially underestimate the costs of attaining the 8-hour standard. For example, without any empirical basis, EPA assumed that no emission control measures would cost more than $10,000 per ton of pollution reductions.[24] After a more realistic assessment of the costs of full attainment of the ozone standard, a number of economists have concluded the total cost would likely range from $54 billion to hundreds of billions of dollars per year. [25]

---

[21] EPA estimated the incremental benefits of full national attainment of the 8-hour ozone standard (beyond the 1-hour standard) would range from $1.5 to $8.5 billion per year. Yet EPA's "central estimate" for incremental attainment costs was $9.6 billion—greater than even the high end of EPA's benefit estimate. EPA, "Regulatory Impact Analyses for the Particulate Matter and Ozone National Ambient Air Quality Standards and Proposed Regional Haze Rule".

[22] Levy et al., "Assessing the Public Health Benefits of Reduced Ozone Concentrations."

[23] EPA, "National Ambient Air Quality Standards for Ozone: Proposed Decision," *Federal Register*, December 13, p. 65715-50.

[24] EPA, *Regulatory Impact Analyses for the Particulate Matter and Ozone National Ambient Air Quality Standards and Proposed Regional Haze Rule* (Washington, DC: July 17, 1997), www.epa.gov/ttn/oarpg/naaqsfin/ria.html.

[25] S. E. Dudley, *Comments on the U.S. Environmental Protection Agency's Proposed National Ambient Air Quality Standard for Ozone* (Arlington, VA: Regulatory Analysis Program, George Mason University, March 12 1997), www.mercatus.org/research/RSP19972.htm, R. Lutter, *Is EPA's Ozone Standard Feasible?* (Washington, DC: AEI-Brookings Joint Center for Regulatory Studies, December 1999), www.aei.brookings.org/publications/reganalyses/reg_analysis_99_06.pdf, A. J. Krupnick, "The Proposed National Ambient Air Quality Standards (NAAQS) for Particulate Matter (PM) and Ozone (Panel 1)," U.S. Senate Subcommittee on Clean Air, Wetlands, Private Property and Nuclear Safety, Committee on Environment and Public Works (Washington, DC: Resources for the Future, April 24, 1997),

Even taking EPA's cost-benefit estimates at face value, the 8-hour standard is a harmful policy. Based on more realistic assessments of likely attainment costs, requiring attainment of the 8-hour ozone standard is certain to cause substantial net harm to public health.

In addition to the costs of regulations, pollution reductions themselves can ironically sometimes cause offsetting harm.[26] For example, although it has harmful respiratory effects, ground-level ozone, like stratospheric ozone, has the beneficial effect of reducing people's exposure to the sun's ultra-violet (UV) light. Reducing ground-level ozone therefore also increases harm due to solar-UV exposure. EPA performed an internal analysis estimating that attaining the 8-hour ozone standard would cause an additional 696 non-melanoma skin cancer cases each year. EPA never officially made this analysis public and did not consider it in setting the 8-hour ozone standard.[27] The U.S. Department of Energy also estimated that attaining the 8-hour ozone NAAQS could increase by several thousand the annual number of cases of cataracts as well as cause some additional deaths each year due to melanoma skin cancer.[28]

In May 1999, the United States Court of Appeals for the District of Columbia Circuit remanded the 8-hour ozone NAAQS to EPA to consider the potential beneficial health effects of ozone pollution in shielding the public from the "harmful effects of the sun's ultraviolet rays."[29] EPA published its decision in January 2003, concluding that the effect of changes in ground-level ozone on ultraviolet exposure "is too uncertain at this time to warrant any relaxation in the level of public health protection previously determined to be requisite to protect against demonstrated direct adverse respiratory effects of exposure to O_3 in the ambient air. Further, it the Agency's view that associated changes in UV–B

---

www.rff.org/testimony/remarks/naaqs1.htm, EPA, *Regulatory Impact Analyses for the Particulate Matter and Ozone National Ambient Air Quality Standards and Proposed Regional Haze Rule*.

[26] See Dudley and Gramm, *Risk Analysis*, Vol. 17, No 4, 1997 and Dudley, *Pace Environmental Law Review,* Vol. 16, No 1, Winter 1998.

[27] The EPA analysis is now posted at aei.brookings.org/admin/pdffiles/php9v.pdf. It suggests that average summer ozone levels would need to be reduced by from one to a few ppb in most 8-hour non-attainment areas in order to attain the standard. Also see, R. Lutter and H. Gruenspect, "Assessing Benefits of Ground Level Ozone: What Role for Science in Setting National Ambient Air Quality Standards?" *Tulane Environmental Law Journal* (Winter 2001), pp. 85-96.

[28] For example, the U.S. Department of Energy estimated that a 10 ppb reduction in average ground-level ozone would result in 25 to 50 additional deaths each year from melanoma skin cancers and an additional 13,000 to 28,000 additional cases of cataracts—or health costs totaling $0.29 to $1.1 billion per year. Based on the internal EPA analysis, this represents about 3 or 4 times the ozone reduction that would be necessary to comply with the 8-hour standard in the vast majority of 8-hour non-attainment areas. On the other hand, ozone precursor reductions will go well beyond those necessary for attainment in many areas, because many of the reductions are national in scope and very stringent, for example, EPA's Tier 2 and heavy-duty rules for on-road vehicles, the NOx SIP call, and the proposed rule for off-road mobile source NOx emissions (see discussion of these rules below). Thus, the mean ozone reduction assumed by DOE could be realistic. On the DOE estimates, see Lutter and Gruenspecht, "Assessing the Benefits of Ground Level Ozone."

[29] F. 3d 1027 (D.C. Circuit 1999).

radiation exposures of concern, using plausible but highly uncertain assumptions about likely changes in patterns of ground-level ozone concentrations, would likely be very small from a public health perspective."[30]

EPA does not mention its internal analysis of non-melanoma skin cancer and ozone in its decision, and is here applying a double standard on the level of certainty necessary to accept scientific evidence for regulatory purposes. For example, as noted earlier, most of the benefits EPA claims for the 8-hour standard are due to presumed reductions in mortality. The uncertainty in these mortality benefits is at least as great if not greater than the uncertainties surrounding estimates of the relationship between UV exposure, ground-level ozone, and health. Nevertheless, this did not deter EPA from claiming billions of dollars per year in mortality-reduction benefits due to lower ozone levels. Likewise, as shown below in section II.C., EPA is willing to tolerate an air pollution planning and regulatory process founded on emission inventories known to contain serious inaccuracies and biases.

The evidence is overwhelming that requiring attainment of the 8-hour ozone NAAQS in its current form would cause net harm to the American public. EPA should ideally have proposed a standard more likely to lead to net benefits. However, since this was not EPA's inclination, and, based on the Supreme Court's opinion, explicit consideration of cost in setting the standard is prohibited, EPA should now go to great lengths to ensure that the standard is implemented so as to minimize the costs it imposes on non-attainment areas—particularly those areas that already attain the 1-hour standard or are expected to attain the 1-hour standard based on already-adopted pollution controls.

B. EPA's 8-Hour NAAQS Rule Will Have At Most A Modest Effect On Emissions, Regardless of Its Final Structure

EPA expended a great deal of effort in assessing the relative merits of classifying non-attainment areas based on Subpart 1 or Subpart 2, whether and how to revoke the 1-hour ozone standard, and on many other formal details of 8-hour ozone implementation. Of course, EPA has a legal obligation to ensure that the requirements of the CAA are faithfully carried out, so this focus is only natural. But that shouldn't distract us from the fact that on the substantive issue of emission reductions, these legal and regulatory niceties will likely make little difference to progress in reducing emissions. The reason for this is that existing national regulations will eliminate most remaining ozone precursors, and these requirements are independent of the 8-hour ozone implementation rule. The NAAQS classification process and the SIP planning process will therefore largely be a formal exercise with at most a modest effect on actual emissions.

Most future NOx reductions are unaffected by the specifics of EPA's 8-hour NAAQS rule. About 75 percent of NOx comes from on-road vehicles and coal-fired electricity

[30] EPA, "National Ambient Air Quality Standards for Ozone: Final Response to Remand; Final Rule," *Federal* Register, January 6, 2003, pp. 614-45.

boilers.[31] But EPA has already adopted rules to eliminate most of these emissions. EPA's NOx SIP Call will reduce NOx from coal-fired boilers by 60 percent during the May-September "ozone season" starting in 2004.[32] EPA's Tier 2 regulation will reduce automobile NOx by 90 percent during the next 20 years or so.[33]

EPA's defeat device settlement for 1990s diesel trucks is reducing NOx from many existing trucks.[34] NOx standards for new trucks built for the 2003 and beyond require a 50 percent reduction below previous limits. EPA's latest heavy-duty standards require an additional 90 percent reduction in new diesel-truck NOx below current requirements starting in 2007, as well as a similar reduction in soot and VOC emissions.[35] NOx from on-road vehicles will decline several percent per year from now on as the fleet turns over to these cleaner models. Almost all remaining on-road vehicle NOx emissions will be eliminated during the next 20 years.

Off-road vehicles are another significant source of NOx, accounting for about 10 percent of the national NOx inventory. EPA recently issued a proposed rule for off-road sources that would reduce NOx emissions by more than 90 percent. [36]

Automobiles alone account for 50 to 75 percent of anthropogenic VOC emissions. Yet a fleet of automobiles meeting EPA's Tier 2 requirements, which phase in starting this year, will emit 90 percent less VOC per mile than the current average vehicle on the road.[37] This means that, just as for NOx, almost all automobile VOC emissions will disappear during the next 20 years or so as the fleet turns over to Tier 2 vehicles. In fact, on-road data from remote sensing and tunnel studies, as well as data from I/M programs, show that average vehicle emissions have been declining about 10 percent per year due to the progressive improvement in vehicle emissions and durability with each new model-year.[38]

---

[31] Emission inventory estimates will be discussed in the next section.

[32] EPA, *Addendum to the Regulatory Impact Analysis for the NOx SIP Call, FIP, and Section 126 Petitions* (Washington, DC: September 1998).

[33] J. Schwartz, *No Way Back: Why Air Pollution Will Continue to Decline* (Washington, DC: American Enterprise Institute, July 2003), EPA, "Control of Air Pollution from New Motor Vehicles: Tier 2 Motor Vehicle Emissions Standards and Gasoline Sulfur Control Requirements; Final Rule," *Federal Register*, February 10, 2000, p. 6698-6870, www.epa.gov/otaq/tr2home.htm#preamble.

[34] EPA, Heavy Duty Diesel Engine Settlement Information, www.epa.gov/compliance/civil/programs/caa/diesel/index.html.

[35] EPA, *Regulatory Impact Analysis: Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements* (Washington, DC: December 2000), www.epa.gov/otaq/diesel.htm.

[36] EPA, "Control of Emissions of Air Pollution from Nonroad Diesel Engines and Fuel; Proposed Rule," *Federal Register*, May 23, 2003, pp. 28328-602, http://www.epa.gov/otaq/url-fr/fr23my03p.pdf.

[37] Schwartz, *No Way Back: Why Air Pollution Will Continue to Decline,* EPA, "Control of Air Pollution from New Motor Vehicles: Tier 2 Motor Vehicle Emissions Standards and Gasoline Sulfur Control Requirements; Final Rule."

[38] Schwartz, *No Way Back: Why Air Pollution Will Continue to Decline*.

Suburbanization and population growth will barely offset the effect of cleaner vehicles. For example, if per-mile emissions decline 90 percent and total vehicle miles traveled increase 50 percent (the high end of typical metropolitan projections), then total vehicle emissions would still decline 85 percent.

Additional EPA rules will eliminate ozone-precursor emissions from many other sources of pollution as well. EPA has adopted rules for lawn and garden equipment, and various non-road engines, such as forklifts, and marine diesel engines that will reduce allowable VOC and NOx emissions from new engines by 70 to 80 percent during the next few years.[39] EPA also already regulates VOC emissions from solvents and coatings, the other significant VOC sources after motor vehicles, and has issued regulations reducing emissions from both of these categories.[40] This suggests that the details of how the 8-hour NAAQS rule is implemented will have little effect on the long-term elimination of most remaining ozone-forming air pollution.

Environmental activists also treat 8-hour NAAQS implementation issues as key decisions that will determine whether the country makes continued progress on ozone. For example:

- The Clean Air Council of Pennsylvania argues that "Subpart 2-based programs that deliver critical emissions reductions in non-attainment areas in Pennsylvania include: enhanced emissions inspection and maintenance programs; Reasonably Available Control Technology (RACT); Reasonable Further Progress (RFP) demonstrations; emissions offsets at higher than one-to-one ratios; and lower emissions thresholds for triggering New Source Review."[41]

- The American Lung Association argues that EPA's proposal to classify some areas under Subpart 1 uses "the exact failed approach of the 1980s in the name of providing 'flexibility' for those new non-attainment areas that violate the eight hour ozone health standard but not the one-hour standard…we believe it weakens requirements and extends deadlines for action such that progress will be unnecessarily slowed or even halted."[42]

---

[39] EPA, *Regulatory Announcement: Final Phase 2 Standards for Small Spark-Ignition Handheld Engines* (Washington, DC: March 2000), http://www.epa.gov/otaq/regs/nonroad/equip-ld/hhsfrm/f00007.pdf, EPA *Regulatory Announcement: Emission Standards for New Nonroad Engines* (Washington, DC: September 2002), http://www.epa.gov/otaq/regs/nonroad/2002/f02037.pdf.

[40] EPA, "National Volatile Organic Compound Emission Standards for Architectural Coatings; Final Rule," *Federal Register*, September 11, 1998, pp. 48848-87, http://www.epa.gov/ttn/atw/183e/aim/fr1191.pdf, EPA, "National Volatile Organic Compound Emission Standards for Consumer Products; Final Rule," *Federal Register*, September 11, 1998, pp. 48819-47, http://www.epa.gov/ttn/atw/183e/cp/fr1193.pdf.

[41] Clean Air Council, "Comments on Proposed Rule to Implement the 8-Hour Ozone Standard, 68 FR 32802, June 27, 2003."

[42] American Lung Association, "Statement of A. Blakeman Early on Behalf of the American Lung Association On U.S. EPA's Proposed Rule to Implement the 8-Hour-Ozone National Ambient Air Quality Standard at the Public Hearing, June 27, 2003, Alexandria, Va."

- The Public Interest Research Group asserts that EPA's proposed rule "will neither reduce smog nor protect our health…we are bound to see more smoggy summers, and more asthma."[43]

- The Clean Air Trust declares, "The controls required to meet the one-hour standard will be essential to any effort to meet the 8-hour standard. To scrap the current program then is to endorse dirtier air for a longer time."[44]

All of these commenters confuse formal administrative and legal requirements with substantive air pollution reductions. They appear to be unfamiliar with the sources responsible for most air pollution, trends in actual pollution emissions, and the measures already in place that will continue to achieve large national reductions in emissions from the pollution sources that contribute the vast majority of ozone precursors.

In their comments on EPA's proposed rule, activists also express concern regarding how New Source Review will apply under the 8-hour NAAQS rule. Once again, this concern is misplaced. The Title IV acid rain program, the NOx SIP Call, and the Section 126 rule all place power plants under hard, declining caps on NOx emissions. Emissions from these sources will thus continue to decline regardless of how NSR is implemented under the 8-hour standard. Indeed, there's a strong case to be made that NSR has slowed progress in cleaning up older, dirtier facilities. NSR makes new facilities more expensive relative to existing ones, and has thus caused many businesses to keep older plants running well beyond their original useful life.[45]

And although environmentalists have claimed that cap-and-trade programs create hot spots, the evidence is just the opposite. Under Title IV, the facilities with the highest emissions were the most likely to reduce their emissions.[46] This is to be expected since the sources with the fewest pollution controls also have the lowest marginal control costs. As a result, they tend to be the first to reduce their emissions in a trading market.[47] A lack of hot spots is also demonstrated by ambient data. The nation is in virtually complete attainment of NOx and sulfur dioxide standards, and at almost all monitoring locations NOx and SO_2 levels are below the standards by a large margin.[48]

---

[43] Zachary Corrigan, "Testimony of Zachary Corrigan, Staff Attorney, U.S. Public Interest Research Group," EPA Ozone Implementation Hearing, June 27, 2003.

[44] Frank O'Donnell, "Statement of Frank O'Donnell, Executive Director, Clean Air Trust," EPA Hearing on Ozone Implementation, June 27, 2003.

[45] Howard K. Gruenspecht and Robert N. Stavins, "New Source Review under the Clean Air Act: Ripe for Reform," *Resources* (Spring 2002), pp. 19-23, www.rff.org/resources_archive/pdf_files/147_gruenStavins.pdf, and B. Swift, "How Environmental Laws Work: An Analysis of the Utility Sector's Response to Regulation of Nitrogen Oxides and Sulfur Dioxide under the Clean Air Act," *Tulane Environmental Law Journal* (Summer 2001), pp. 309-425.

[46] Ibid.

[47] Ibid.

[48] Based on author's analysis of ambient monitoring data downloaded from EPA's AirData web site, www.epa.gov/aqspubl1/select.html.

Overall, environmental activists are incorrect when they claim EPA's policies on implementation of the 8-hour rule, such as whether areas are classified based on Subpart 1 or Subpart 2, or how NSR is implemented, will have much effect on progress in reducing ozone precursors. Actions necessary to eliminate most ozone precursors have already been taken, and are progressing independently of the 8-hour NAAQS rule and other administrative CAA requirements.

Since the NAAQS classification and SIP planning process will have little effect on future reductions in ozone precursors, there is little risk to air quality in providing as much flexibility as possible to non-attainment areas so they can seek least-cost methods for meeting their CAA obligations. This argues for classifying as many areas as possible under Subpart 1, and providing the incentive programs that would allow additional areas to be classified under less restrictive and bureaucratic regulatory regimes.

C. Key Factors Affecting 8-Hour Ozone NAAQS Implementation And Progress

The 8-hour standard is problematic from the point of view of net benefits. But ozone control policy, including attainment of the 8-hour standard, is also plagued by technical problems that makes policy implementation more expensive and less effective than it might otherwise be. Key issues include:

- Known inaccuracy of the emission inventories used as a basis for pollution modeling and control measure development,
- The potential detrimental effects of NOx reductions for ozone control, and the practical feasibility of attaining the 8-hour ozone standard by regulatory deadlines,
- The degree to which EPA's one-size-fits-all national regulations for major NOx sources foreclose the ability of local regions to develop tailored control strategies that might be more effective in reducing ozone.

Each of these issues is discussed in more detail below.

1. Air Pollution Policies, Plans, and Regulations Are Based on Errant Emission Inventories

The official emission inventories generated and used by EPA and state regulatory agencies for SIP planning and implementation have been shown repeatedly to suffer from often-serious inaccuracies and biases.[49] Problems with inventories include errors in the

[49] A full discussion is beyond the scope of this paper, but see, for example, E. M. Fujita et al., "Receptor Model and Emissions Inventory Source Apportionments of Nonmethane Organic Gases in California's San Joaquin Valley and San Francisco Bay Area," *Atmospheric Environment*, vol. 29 (1995), pp. 3019-3035, L. C. Marr et al., "Formation of Photochemical Air Pollution in Central California. 1. Development of a Revised Motor Vehicle Emission Inventory," *Journal of Geophysical Research*, vol. 107 (2002), pp. 5-1 -

total amount of emissions, as well as errors in the apportionment of emissions among various source categories. The most serious inventory problems center on VOC and CO, while problems with NOx inventories appear to be more modest. Since emission inventories are a fundamental input to the process of choosing pollution reduction measures and to the modeling used to demonstrate future attainment of NAAQS, an inaccurate inventory is likely to lead to poor policy choices in terms of cost, effectiveness, or both.

VOCs and NOx are ozone precursors. Although virtually the entire country now complies with federal health standards for CO itself, CO also acts as an ozone precursor, though it is much less reactive than VOCs.[50]

Official emission inventories have persistently underestimated the fraction of total anthropogenic VOC emissions coming from motor vehicles and from gasoline vehicles in particular. Official inventories typically have only about one-third to one-half of VOC emissions coming from gasoline vehicles. For example, EPA's national VOC inventory attributes only 42 percent of VOCs to gasoline vehicles.[51] But studies based on ambient measurements of VOCs in air, combined with source apportionment analysis, conclude that about 50 to 75 percent of VOCs come from gasoline exhaust and evaporation.[52] MOBILE6, the latest version of the emission factor model EPA uses to estimate on-road

---

5-9, Solomon et al., "Comparison of Scientific Findings from Major Ozone Field Studies in North America and Europe," Brett C. Singer et al., "A Fuel-Based Approach to Estimating Motor-Vehicle Cold-Start Emissions," *Journal of the Air and Waste Management Association*, vol. 49 (1999), pp. 125-135, B. C. Singer et al., "A Fuel-Based Assessment of Motor Vehicle Emissions in Southern California," *Journal of the Air & Waste Management Association*, vol. 49 (1999), pp. 125-135, W. R. Pierson et al., "Assessment of Nontailpipe Hydrocarbon Emissions from Motor Vehicles," *Journal of the Air and Waste Management Association*, vol. 49 (1999), pp. 498-519, A. W. Gertler et al., "Assessing Real-World Vehicle Emissions Using Roadway Tunnels," 11th World Clean Air and Environmental Congress, Durban, SA, September 13-18, 1998, W. R. Pierson et al., "Comparison of the SCAQS Tunnel Study with Other on-Road Vehicle Emission Data," *Journal of the Air & Waste Management Association*, vol. 40, no. 11, November (1990), pp. 1495-1504, E. M. Fujita et al., "Comparison of Emission Inventory and Ambient Concentration Ratios of Co, NMOG, and NOx in California's South Coast Air Basin," *Journal of the Air and Waste Management Association*, vol. 42, no. 3 (1992), pp. 264-276, C. Tran et al., *Validation of the U.S. EPA MOBILE6 Highway Vehicle Emission Factor Model* (Atlanta: Coordinating Research Council, 2002), A. J. Kean et al., "A Fuel-Based Assessment of Off-Road Diesel Engine Emissions," *Journal of the Air & Waste Management Association*, vol. 50 (2000), pp. 1929-1939.

[50] W. P. L. Carter, *The Saprc-99 Chemical Mechanism and Updated Voc Reactivity Scales* (Sacramento, CA: California Air Resources Board, 1999). CO forms about 60 times less ozone per molecule than the average gasoline VOC. But since total CO emissions are several times greater than total VOC emissions, CO can account for a non-trivial amount of ozone formation.

[51] Based on EPA spreadsheet of emissions estimates by source category for 2001, downloaded from http://www.epa.gov/ttn/chief/trends/index.html.

[52] J. G. Watson et al., "Review of Volatile Organic Compound Source Apportionment by Chemical Mass Balance," *Atmospheric Environment*, vol. 32 (2001), pp. 1567-1584. In California, home to the highest ozone levels in the country, source apportionment studies typically attribute 70% to 75% of VOC emissions to gasoline exhaust and evaporation.

mobile source emissions, also appears to overestimate mobile source VOC emissions when compared with on-road measurements of actual automobile emissions.[53]

Another important feature of automobile VOCs, is that their distribution is very skewed toward a few very high emitters. Remote sensing measurements in a number of metropolitan areas show that the worst 5 percent of VOC emitters contribute about 50 percent of tailpipe VOC emissions.[54] Though the concentration of emissions in a few "gross polluters" has been understood among air pollution scientists for at least 20 years, it has not been a significant factor in federal or state air pollution policy decisions. As a result, the substantial and inexpensive emission reductions available from repair or scrappage of gross polluters remain unrealized.[55]

The vast majority of CO emissions in metropolitan areas come from gasoline vehicles.[56] MOBILE6 was intended to be an improvement over MOBILE5b, which had been found to overestimate CO emissions when compared with actual emission measurements. However, a recent study that compared MOBILE6 to "real-world" emissions data from tunnel studies found that MOBILE6 overestimates automobile CO emissions by at least a factor of two—a far worse performance than MOBILE5b.[57]

Past studies have found serious problems with the NOx inventory as well, but EPA has improved its NOx inventory during the last few years. For example, a mobile-source NOx inventory based on MOBILE5b and an early version of EPA's NONROAD model for estimating off-road vehicle emissions underestimated diesel truck NOx emissions by

---

[53] Tran et al., *Validation of the U.S. EPA MOBILE6 Highway Vehicle Emission Factor Model*. If mobile source VOC emissions are overestimated, and the fraction of all anthropogenic VOCs coming from automobiles is underestimated, then the absolute levels of emissions from other VOC sources must be overestimated.

[54] Author's analysis of remote sensing data for Chicago, Denver, Phoenix, and Riverside, CA, collected by Gary Bishop and Don Stedman of the University of Denver, and downloaded from http://www.feat.biochem.du.edu/. Also see Schwartz, *No Way Back: Why Air Pollution Will Continue to Decline*. Remote sensing, I/M, and other emissions surveillance data from the 1980s and early 1990s showed that about 10% of vehicles contributed 50% of VOC and CO emissions (not necessarily the same 10% for each pollutant, though there is significant overlap). The fleet emissions distribution is becoming more skewed with time as the fleet turns over to more recent models that start out and stay cleaner than their predecessors. As a result, a smaller percentage of the vehicle fleet has very high emissions. See, for example, D. H. Stedman et al., *On-Road Remote Sensing of CO and HC Emissions in California* (Denver: University of Denver, 1991), D. H. Stedman et al., *On-Road Carbon Monoxide and Hydrocarbon Remote Sensing in the Chicago Area* (Chicago: Illinois Department of Energy and Natural Resources, October 1991), L. G. Wayne and Y. Horie, *Evaluation of ARB's in-Use Vehicle Surveillance Program, Final Report* (Sacramento: California Air Resources Board, October 1983).

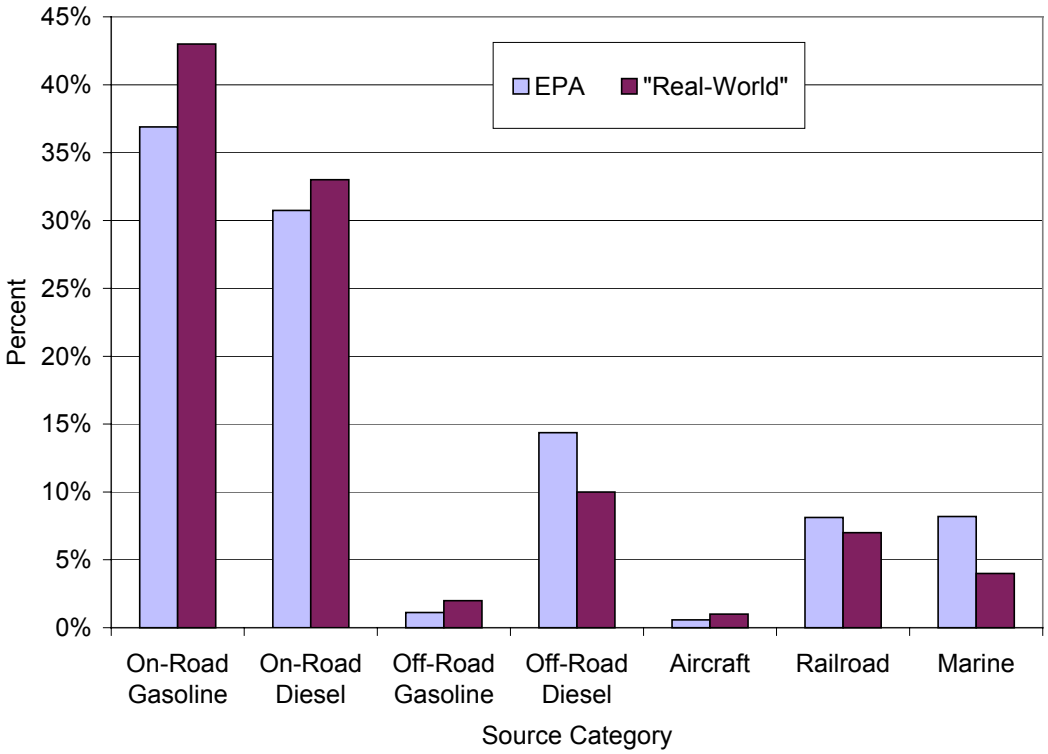
[55] See, for example, D. R. Lawson et al., *Program for the Use of Remote Sensing Devices to Detect High-Emitting Vehicles, Prepared for the South Coast Air Quality Management District* (Reno: Desert Research Institute, April 16, 1996), Eastern Research Group, *Overview of Voluntary Vehicle Scrap Programs for Reducing in-Use Vehicle Emissions* (Austin: June 2002).

[56] EPA, *Latest Findings on National Air Quality: 2000 Status and Trends* (Washington, DC: September 2001), www.epa.gov/oar/aqtrnd00/brochure/00brochure.pdf.

[57] Tran et al., *Validation of the U.S. EPA MOBILE6 Highway Vehicle Emission Factor Model*.

a factor of two and overestimated off-road vehicle emissions by a factor of 2.5 when compared with inventories based on actual measurements of vehicle emissions and total fuel consumption.[58] In this case, the overall mobile-source NOx inventory appeared to be accurate, despite the inaccurate apportionment among sources. EPA has eliminated much of this discrepancy in the latest versions of MOBILE and NONROAD, as shown in Figure 3. Nevertheless, the current official NOx inventory still substantially overestimates the relative NOx contribution from off-road diesel vehicles (a category composed mainly of farm and construction equipment) and marine vessels.

Figure 3. Percent of Mobile Source NOx Emissions by Source Category in 1996: Official EPA Inventory Compared with "Real-World" Estimate



Sources: EPA inventory spreadsheet was downloaded from http://www.epa.gov/ttn/chief/trends/index.html. "Real-world" inventory is from A. J. Kean et al., "A Fuel-Based Assessment of Off-Road Diesel Engine Emissions." The graph is based on an estimate for 1996 because Kean et al. estimated the national NOx inventory only for that year.

[58] Kean et al., "A Fuel-Based Assessment of Off-Road Diesel Engine Emissions."

2. EPA's Has Not Adequately Addressed the Potentially Detrimental Effect of NOx Reductions on Ozone Formation

Air quality scientists have been aware for some time that ozone levels are higher or the same on weekends in most areas of the United States, even though NOx emissions decline 10 to 40 percent on weekends due to substantial reductions in diesel truck and off-road diesel equipment activity. The phenomenon is known as the "weekend effect" and scientists consider it a telltale sign that NOx reductions might not be effective in reducing ozone, given the current mix of VOC and NOx in most metropolitan areas.[59]

For example, out of almost 1,200 ozone-monitoring locations around the U.S., weekend 8-hour ozone is higher at 35 percent of sites, roughly the same at 60 percent of sites, and lower at only 5 percent of sites.[60] Yet NOx monitoring data indicate that NOx declines 10 to 40 percent on weekends. VOC emissions also decline on weekends, but much less so than NOx. As a result, the VOC/NOx ratio increases.

This weekend change in emissions can be thought of as a natural experiment to test out a pollution control strategy. Every weekend, NOx, an ozone precursor, declines substantially, yet ozone levels generally stay the same or increase. Based on a combination of modeling and empirical observations, the cause appears to be that when the VOC/NOx ratio falls below about 10, the chemistry of ozone formation enters a regime referred to as "VOC limited." In this situation, NOx reductions don't reduce ozone; at lower VOC/NOx ratios, NOx reductions can even increase ozone.[61] Because VOC emissions have been declining more rapidly than NOx during the last two decades, the VOC/NOx ratios in most urban areas have been declining, and there is evidence that the detrimental effect of NOx reductions has been increasing in magnitude and in geographic scope.[62] This research suggests that the urbanized areas of many metropolitan areas are VOC limited.

---

[59] A detailed discussion of the nature and explanation for the weekend effect can be found in a series of seven peer-reviewed research papers in the July 2003 issue of the Journal of the Air and Waste Management Association. A summary of the research can be found in D. R. Lawson, "The Weekend Effect--the Weekly Ambient Emissions Control Experiment," *Environmental Manager*, July 2003, p. 17-25. The same issue of Environmental Manager has a companion article by staff from the California Air Resources Board, which disputes the conclusions of the independent researchers who performed the various studies. See B. E. Croes et al., "The O3 'Weekend Effect' and NOx Control Strategies: Scientific and Public Health Findings and Their Regulatory Implications," *Environmental Manager*, July 2003, p. 27-35.

[60] J. M. Heuss et al., "Weekday/Weekend Ozone Differences: What Can We Learn from Them," *Journal of the Air & Waste Management Association*, vol. 53, no. 7 (2003), pp. 772-788.

[61] Lawson, "The Weekend Effect--the Weekly Ambient Emissions Control Experiment," N. Carslaw and D. Carslaw, "The Gas-Phase Chemistry of Urban Atmospheres," *Surveys in Geophysics*, vol. 22 (2001), pp. 31-53, J. H. Seinfeld, "Urban Air Pollution: State of the Science," *Science*, vol. 243 (1989), pp. 745-752.

[62] See, for example, L. C. Marr and R. A. Harley, "Spectral Analysis of Weekday-Weekend Differences in Ambient Ozone, Nitrogen Oxide, and Non-Methane Hydrocarbon Time Series in California," *Atmospheric Environment*, vol. 36 (2002), pp. 2327-2335, L. C. Marr and R. A. Harley, "Modeling the Effect of Weekday-Weekend Differences in Motor Vehicle Emissions on Photochemical Air Pollution in Central

The mainly VOC-focused pollution control strategy of the last two to three decades has been relatively successful in mitigating the worst ozone problems and bringing most areas into compliance with the 1-hour ozone standard. However, the results of weekend effect research suggest that reducing 8-hour ozone levels from their current relatively moderate levels in most 8-hour non-attainment areas down to the very stringent requirements of the 8-hour standard may be difficult over much of the U.S.

As noted earlier, already adopted EPA requirements will eliminate most NOx and VOC emissions during the 20 years or so. Because of the risk that NOx reductions might increase ozone levels or at least slow progress in reducing them, EPA's NOx control policies might backfire and make ozone worse in some areas, particularly in urbanized areas where most people live, because they are the most likely to be VOC limited. Indeed, after a decade of spectacular ozone reductions in California's South Coast Air Basin, ozone levels have been flat or perhaps even rising since 1999, despite the fact that precursor NOx and VOC emissions have been declining. While weather or other random factors might at least partially explain the flattened trend, weekend effect research shows that the South Coast has been becoming more and more VOC limited and NOx reductions are therefore becoming more and more detrimental to ozone reduction.

Recent research makes a strong case that all of California's large metropolitan areas—South Coast, San Diego, and the San Francisco Bay Area—are now VOC limited, as are the urban cores of Central Valley cities.[63] Other cities, such as Philadelphia and Chicago are in a similar situation.[64] The fact that ozone levels are the same or higher on weekends at almost all monitoring locations, despite lower NOx emissions on weekends, suggests that most areas of the U.S. are at best insensitive to NOx reductions on the order of 10 to 40 percent.

Recent modeling results for California and the eastern U.S. suggest that NOx would have to be reduced 70 to 90 percent in order to attain the 8-hour standard at all monitoring locations in most non-attainment areas.[65] These studies also concluded that more modest NOx reductions would increase ozone in some areas, including New York City, Philadelphia, and Chicago. The modeling also concluded that VOC reductions were

---

California," *Environmental Science & Technology*, vol. 36 (2002), pp. 4099-4106, Lawson, "The Weekend Effect--the Weekly Ambient Emissions Control Experiment."

[63] Marr and Harley, "Modeling the Effect of Weekday-Weekend Differences in Motor Vehicle Emissions on Photochemical Air Pollution in Central California," Marr and Harley, "Spectral Analysis of Weekday-Weekend Differences in Ambient Ozone, Nitrogen Oxide, and Non-Methane Hydrocarbon Time Series in California," B. K. Pun and C. Seigneur, "Day-of-Week Behavior of Atmospheric Ozone in Three U.S. Cities," *Journal of the Air & Waste Management Association*, vol. 53, no. 7 (2003), pp. 789-801.

[64] Pun and Seigneur, "Day-of-Week Behavior of Atmospheric Ozone in Three U.S. Cities."

[65] S. Reynolds and C. L. Blanchard, *Understanding the Effectiveness of Precursor Reductions in Lowering 8-Hour Ozone Concentrations in the Eastern United States* (San Rafael, CA: Envair, June 9 2003), S. Reynolds et al., "Understanding the Effectiveness of Precursor Reductions in Lowering 8-Hr Ozone Concentrations," *Journal of the Air & Waste Management Association*, vol. 53, no. 2 (2003), pp. 195-205. These studies concluded that peak 1-hour ozone levels are more easily reduced than 8-hour levels, consistent with actual experience during the last decade.

effective in reducing ozone in VOC-limited urban core areas, such as New York City, Philadelphia and Chicago, but less so in other areas, where very large VOC reductions would be needed to produce substantial ozone reductions.

Over the long run, EPA's existing NOx reduction rules will achieve very large reductions. However, for much of the roughly two decades it would take to achieve these NOx reductions through fleet turnover, many areas will likely experience ozone increases. Indeed, EPA's own modeling for its Tier 2 automobile regulation predicted that implementing Tier 2 would make ozone worse in many areas, including much of Texas and California.[66]

Ozone would begin to decline again once sufficient NOx reductions render the VOC/NOx ratio high enough to make NOx reductions once again effective in reducing ozone. Since such large NOx reductions could likely not be achieved within the timeframe envisioned in EPA's proposed 8-hour regulation—all but two non-attainment areas would have 10 years or less to attain the 8-hour standard based on EPA's initial classification estimates—it is probable that attaining the 8-hour ozone standard is not physically feasible in much of the United States.

a) Implications for Ozone Control Strategy

Optimal ozone control policy for a given region depends on a number of factors, including:

- The specifics of local or regional ozone formation chemistry in terms of the effectiveness of NOx and VOC reductions in reducing ozone.
- The degree to which future reductions of ozone precursors are under policymakers' control.
- The speed with which precursors can be reduced.
- The relative costs of reducing a given ozone precursor.
- Judgment about the relative uncertainties pertaining to various pollution control options.

Control strategy. The current state of the science suggests that VOC reductions are a less risky policy, in that they appear to be at least somewhat effective in most areas and very effective in some populous urban areas for reducing 8-hour ozone. VOC reductions also entail no risk of increasing ozone. On the other hand, while large NOx reductions will very likely reduce ozone, the path to get there will increase ozone in many areas. These are general conclusions that might vary somewhat from place to place, based on local conditions.

[66] Abt Associates, *Tier II Proposed Rule: Air Quality Estimation, Selected Health and Welfare Benefits Methods, and Benefit Analysis Results* (Research Triangle Park, NC: EPA, April 1999).

Policymakers' influence over future emission reductions. Some future NOx reductions are not under policymakers' control, even in principle. More recent automobile models start out and stay cleaner than earlier models. Data from remote sensing, tunnel studies and I/M programs suggest average automobile NOx emission rates are declining about 5 to 10 percent per year due to fleet turnover.[67] Tier 2 (and in California LEV II) emission standards are phasing with the upcoming 2004 model year, so these declines will continue far into the future. NOx emissions from diesel trucks are also likely on the decline, as the fleet turns over to 1999+ models and as NOx defeat devices are removed from 1990s models. Together, automobiles and diesel trucks probably account for about 40 percent of current total NOx emissions. Substantial NOx reductions from these sources are unstoppable, because they depend only on natural retirement of earlier models as they wear out and leave the fleet.

Other NOx reductions, such as the NOx SIP Call, and the 2007 standards for heavy-duty trucks are in principle under policymakers' control, but would be politically difficult to delay without ironclad evidence that NOx reductions are ineffective or detrimental for ozone control.

A greater fraction of VOC reductions are out of policymakers' control. Automobiles account for 50 to 75 percent of VOC, and data from remote sensing, tunnels, and I/M programs indicate average automobile VOC emission rates are declining 11 to 15 percent per year due to fleet turnover to inherently cleaner models.[68] Tier 2 and LEV II ensure these declines will continue well into the future.

Roughly speaking, these results suggest that VOC is dropping more rapidly than NOx, and that future VOC reductions are less under policymakers' control than NOx reductions.

Cost and potential speed of reductions. Policy is constrained by the long lead times necessary to reduce emissions from some sources. For example, the automobile fleet turns over on roughly a 15-20 year timescale, while diesel trucks last even longer. This means that most of the benefits of emission standards for new vehicles won't be realized until several years after the standards come into effect. On the other hand, retrofit controls on, say, power plants, can achieve large reductions rapidly. Retrofits are available for some engines and motor vehicles, but these tend to be less cost effective than retrofits on large industrial point sources.

Despite long fleet turnover times, the concentration of VOC and CO emissions in a few gross polluting automobiles provides a means for large, rapid reductions in these pollutants. As noted earlier, the worst 5 percent of VOC emitters account for about 50

[67] Schwartz, *No Way Back: Why Air Pollution Will Continue to Decline*. These annual percentage changes are always relative to the previous year—that is, they represent an assumption of exponential decline, which provides a good fit to the data, and a more physically reasonable fit than linear decline (which would project zero emissions in just a few years from now).

[68] Ibid.

percent of VOC tailpipe emissions. Roughly the same is true for CO emissions, with some overlap between the worst 5 percent for each pollutant. NOx is not as concentrated—the worst 5 percent of NOx emitters accounts for about 35 percent of NOx emissions, and there is less overlap with the gross polluters for the other two pollutants.

Rapid and substantial VOC and CO reductions could be achieved through a gross-polluter repair or voluntary scrap program based on remote sensing.[69] Since automobiles account for most VOC and almost all CO, a successful program would substantially reduce the overall VOC and CO inventories in non-attainment areas. Numerous studies have already proven that gross polluters can be identified on the road with remote sensing.[70] Scrap programs that target vehicles based on age have an estimated cost effectiveness of about $5,000 per ton.[71] Since remote sensing can target the very highest emitters and the vehicles that are driven the most, a remote sensing-based program could probably achieve a substantially lower cost per ton. To give a rough idea of the potential costs and impact, a program that repaired or scrapped the highest-emitting 3 percent of VOC emitters in non-attainment areas would cost at most about $3 billion, and could potentially reduce automobile VOC emissions by 25 to 35 percent.[72] While $3 billion is a considerable sum in absolute terms, there likely is no other measure or set of measures that could rapidly and permanently remove such a large portion of the emission inventory at so low a cost.[73]

---

[69] NOx reductions could also be achieved, but with a much smaller effect on the overall emission inventory.

[70] D. R. Lawson et al., "Emissions from In-Use Motor Vehicles in Los Angeles: A Pilot Study of Remote Sensing and the Inspection and Maintenance Program," *Journal of the Air & Waste Management Association*, vol. 40, no. 8 (1990), pp. 1096-1105, D. H. Stedman et al., *Provo Pollution Prevention Program: A Pilot Study of the Cost Effectiveness of an On-Road Vehicle Emissions Reduction Program* (Provo, Utah: University of Denver, January 15, 1993), D. H. Stedman et al., *On-Road Remote Sensing of CO and HC Emissions in California - Final Report* (Sacramento: California Air Resources Board, February 1994), Lawson et al., *Program for the Use of Remote Sensing Devices to Detect High-Emitting Vehicles, Prepared for the South Coast Air Quality Management District*, National Research Council, *Evaluating Vehicle Emissions Inspection and Maintenance Programs* (Washington, DC: National Academy Press, 2001).

[71] Eastern Research Group, *Overview of Voluntary Scrap Programs for Reducing In-Use Vehicle Emissions* (Austin, TX: June 2002).

[72] Assuming that roughly 100 million cars are driven in 8-hour non-attainment areas, and that cars could be identified and either repaired or scrapped at an average cost of no more than $1,000—a generous sum based on previous targeted scrap and repair efforts. The emission reductions depend on the effectiveness of repairs, the percentage of total automobile VOC emissions coming from the tailpipe, and the overlap between high tailpipe emitters and high evaporative/liquid leak emitters. Compliance with such a program would also depend on incentives—carrots likely being more effective than sticks.

[73] The cost would also be one-time, whereas many other pollution control measures impose ongoing costs. Indeed one might ask why this policy option has received so little attention from regulators and environmentalists. The main barriers to capturing this large source of rapid and inexpensive VOC and/or CO reductions have been political and bureaucratic. Regulatory agencies continue to assume implicitly that automobiles contribute a smaller fraction of VOCs than research has demonstrated them to contribute, and also to ignore the concentration of most of these VOCs in a small fraction of the automobile fleet.

In addition, despite evidence of their relatively limited effectiveness, EPA continues to grant substantial emission reduction SIP credit to I/M programs. States have little incentive to protest this undue credit, since

The above analysis is not intended to be comprehensive, but only to suggest some important directions to consider in assessing options for ozone control policy. To the extent that EPA intends to enforce the 8-hour standard in its current form, a strategy focusing on large near-term VOC and CO reductions appears most likely to reduce ozone to some extent in most places, and to a great extent in some populous urban areas. Yet this strategy avoids the risk of increasing ozone that goes along with a focus on NOx reductions. A VOC/CO strategy could be even more effective to the extent that some otherwise-planned NOx reductions could be delayed for a few years, because the modeling results suggest that NOx reductions are less likely to increase ozone once substantial VOC reductions have occurred.[74]

The above discussion is somewhat general. EPA should also give greater consideration to the potential benefits of emission control strategies tailored to the specifics of ozone formation chemistry in different regions. This might be more effective in combating ozone than a national one-size-fits-all policy, but it would require EPA to rethink its one-size-fits-all national regulations. To the extent optimal ozone control policies vary from place to place, EPA should ensure that the 8-hour classification and incentive scheme it adopts provides enough flexibility for different regions to adopt different control strategies.

IV. Conclusions and Recommendations

The major policy considerations raised above can be summarized as follows:

- Requiring national attainment of the 8-hour standard will impose costs on Americans far in excess of the value of any health benefits achieved.

- A series of already-adopted EPA requirements will eliminate the vast majority of remaining ozone precursor emissions during the next 20 years or so. These reductions will occur regardless of the details of 8-hour ozone NAAQS implementation.

---

it could result in costly sanctions. But the unfortunate result for air quality is that state and federal regulators tacitly make believe that gross polluting cars aren't on the road, even though they continue to appear in remote sensing and other on-road emission data. Since paper credit has already been granted for phantom emission reductions, and highlighting the gross polluter problem could raise embarrassing questions about the effectiveness of I/M programs, state and federal environmental managers have done little to ensure that gross polluters are repaired or scrapped.

For their part, environmentalists have also ignored the importance of automobile VOCs and the concentration of VOCs in a few gross polluters. As shown by their comments on the 8-hour implementation rule, environmentalists are often unfamiliar with real-world data on emissions sources and the nature and effects of existing pollution reduction requirements. A focus on gross-polluting automobiles also fits poorly into environmental activists ideological focus on industrial and commercial pollution sources.

[74] The NOx SIP Call will provide a test of the effect of NOx reductions on ozone. The SIP Call goes into effect in May 2004. Assuming the inventory is accurate, the SIP Call will reduce total eastern NOx emissions by roughly 20 percent (assuming coal-fired boilers account for one-third of eastern NOx and emissions are reduced 60 percent).

- It follows that the details of how non-attainment areas are classified and treated under the 8-hour NAAQS rule will have at most a modest effect on future emission reductions.

- The details of how non-attainment areas are classified and treated under the 8-hour NAAQS rule could have significant impacts on the *costs* of achieving emission reductions, however.

- Persistent inaccuracies in official emission inventories have hindered regulatory acknowledgement and mitigation of the automobile VOC and CO gross polluter problem.

- Ozone "weekend effect" observations and ozone modeling applied to many metropolitan areas suggest that modest NOx reductions are either ineffective or detrimental for ozone control in most areas.

- Recent ozone modeling studies suggest that NOx reductions on the order of 70 to 90 percent would be necessary to attain the 8-hour standard in much of the United States. Many areas would experience ozone increases on the way to achieving these ultimate reductions. VOC reductions, on the other hand, appear to be somewhat effective in reducing ozone in many places, and very effective in some populous urban areas.

- The state of the science suggests that in the near-term, a focus on VOC and CO reductions is entails lower risks and higher returns than NOx reductions.

- An on-road gross polluter identification and repair/scrappage program could achieve substantial and rapid reductions in the overall VOC and CO inventories, and at relatively low cost.

- Optimal ozone control strategies likely vary from place to place.

Recommendations:

These results first suggest that EPA should not implement the 8-hour standard, or should implement a less stringent 8-hour standard—perhaps an 8-hour standard of stringency roughly equivalent to the current 1-hour standard. Since EPA's national NOx reduction rules are geared toward achieving attainment of the 8-hour standard, these rules would also not need to be as stringent if EPA adopts this recommendation.

If EPA does proceed to implement the 8-hour standard, it should reconsider its focus on large, near-term NOx reductions, as they are likely to worsen ozone in at least some areas and slow progress in others.

Further, since the details of how non-attainment areas are classified and treated under the 8-hour NAAQS rule will have a trivial effect on the benefits of the rule, but could have significant impacts on the costs of achieving emission reductions, the agency should seek to maximize the flexibility non-attainment areas have in developing and implementing SIPs to attain the standard. This is a low-risk strategy, since existing regulations, if left

unchanged, will eliminate the vast majority of remaining ozone precursors during the next two decades, regardless of the 8-hour NAAQS implementation rule's provisions. With that in mind, EPA should place as many non-attainment areas as possible under Subpart 1. Non-attainment classification Option 2 and the incentive feature appear to provide the greatest opportunity for achieving that goal.

Finally, EPA should develop realistic emission inventories and require states to do the same. Known errors in these inventories continue to misdirect emission reduction efforts. In particular, too little focus has been placed on the potential for rapid, substantial VOC and CO reductions from the in-use automobile fleet.

APPENDIX I
RSP CHECKLIST

Element	Agency Approach	RSP Comments
1. Has the agency identified a significant market failure?	Rules for designation of non-attainment areas, and SIP requirements that flow from a given non-attainment classification **Grade: NA**	The proposed rule flows from EPA's NAAQS-setting process. While some aspects of air pollution emissions might fall under the "market failure" paradigm, the proposed 8-hour NAAQS rule is far removed from such considerations and instead results from the Clean Air Act's process requirements for NAAQS non-attainment areas, and EPA's regulations and guidance based on those legal strictures.
2. Has the agency identified an appropriate federal role?	Proposed process requirements that states must follow in meeting CAA SIP requirements **Grade: C**	The Clean Air Act has established a pre-existing role for EPA to develop and promulgate regulations and guidance toward attainment of clean-air standards.
3. Has the agency examined alternative approaches?	The proposed rule includes a number of different options EPA is considering for how to implement the 8-hour ozone NAAQS. **Grade: C**	Although EPA has considered a number of approaches, none of EPA's options mitigate the risk that current policies will worsen ozone in some areas. EPA also implicitly assumes that the 8-hour standard is attainable within the time allotted by the proposed regulation, which is unlikely to be true in many areas. EPA has already concluded that measures necessary to attain the 8-hour ozone standard will cause net harm by imposing costs in excess of benefits. EPA's existing national regulations may foreclose some non-attainment areas' flexibility to tune ozone-precursor reduction strategies to fit local ozone-production chemistry.

Element	Agency Approach	RSP Comments
4. Does the agency attempt to maximize net benefits?	EPA is considering options that would maximize flexibility to the extent feasible within CAA strictures, which should to some extent reduce attainment costs. **Grade: C**	EPA promulgated the 8-hour ozone NAAQS even though its own analysis concluded that requiring attainment of the 8-hour standard would cause net harm. More realistic analyses of attainment costs make the cost-benefit picture look even worse, as does inclusion of EPA's own (unreleased) analysis of increased cancers due to lower ground-level ozone.
5. Does the proposal have a strong scientific or technical basis?	EPA's own cost benefits analysis concluded that implementing the 8-hour ozone standard would cause net harm. **Grade: D**	The standard on which the proposal would implement rests on a weak scientific basis in terms of net benefits. Furthermore, pre-existing EPA rules focused on large nationwide NOx reductions ignore a substantial body of evidence that NOx reductions will *increase* ozone in some metropolitan areas. EPA is also using an inaccurate emissions inventory that substantially understates the contribution of gasoline vehicles to VOC emissions, downplaying the importance of repair and scrappage of VOC "gross polluters" in reducing VOC emissions. Thus, implementation of the 8-hour is problematic due to a range of scientific and technical problems.
6. Are distributional effects clearly understood?	Not addressed **Grade: F**	Since the costs of attaining the 8-hour standard will be far greater than the potential health benefits achieved, implementing the 8-hour standard will likely cause relatively more harm to those with lower incomes. EPA has not addressed these distributional issues.
7. Are individual choices and property impacts understood?	Not addressed **Grade: F**	The imposition of federal standards for air quality and emissions implicitly ignores the wishes of local regions in terms of determining how clean is clean enough, how emissions should be reduced, and who should be responsible for reducing them. EPA could have promulgated a less stringent ozone standard. However, given that the standard has already been promulgated, the issue of local or individual choices has become moot.