Policy Analysis

Cato Institute Policy Analysis No. 233: Time to Reopen the Clean Air Act: Clearing Away the Regulatory Smog

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Executive Summary

National policy on the control of urban smog is misguided because it fails to account for current pollution trends and is based on the anomalous meteorological conditions of 1988. Although new data on smog have shown that the trends are continuing downward, the Environmental Protection Agency is doing little to halt regulatory overkill.

That is particularly true in the Ozone Transport Region--the 12 states from Virginia to Maine. The state-level regulatory programs are being coordinated through the Ozone Transport Commission, which was established under the 1990 Clean Air Act Amendments. The OTC has proposed emissions control strategies that are not only unnecessary, ineffective, and expensive but are also scientifically insupportable. The OTC has encouraged the imposition of low-emission vehicle standards similar to California's, which include zero-emission vehicles or electric cars.

In response to the CAAA, the EPA has promoted various emission control strategies, including enhanced vehicle emission inspections and carpooling programs, that are similarly ill conceived. The sort of "control for control's sake" pollution control strategies pursued by the EPA and the OTC are largely inappropriate because they are neither cost-effective nor equitable means of achieving emissions reductions, even should such reductions be necessary. Moreover, most of those policies are based on faulty assumptions about the nature and severity of ozone air pollution in the United States today and the proper means of addressing it.

Those findings clearly suggest the need for legislative action to alleviate unneeded and costly regulatory mandates under the 1990 Clean Air Act Amendments.

Introduction

Local officials in selected metropolitan areas around the country are scrambling to meet federal deadlines for compliance with the Clean Air Act Amendments of 1990 (CAAA). For many cities, that meant submitting an acceptable state implementation plan in November 1994, a deadline that was not universally met. Failure to meet federal requirements can result in federal sanctions, including the loss of federal highway funds and the disapproval of future federal construction permits. Not only do those plans have to pass federal muster, but they must satisfy the statutory interpretation of environmental groups as well, since the CAAA include public suit provisions to force the imposition of federal sanctions.[1]

The Environmental Protection Agency, in response to CAAA mandates that the agency essentially wrote, has proposed a wide range of policies, from mandatory carpooling and enhanced inspection and maintenance programs to

technology standards for factory emissions and new emissions controls on lawn mowers, snow blowers, chain saws, and the like. Although those policies are costly to businesses and consumers, the EPA claims they are nonetheless reasonable and necessary policies for reducing the threats to public health posed by supposedly poor ozone air quality in America's cities.

The EPA has encountered significant opposition to several of its proposed policies, particularly those that require stringent emissions inspection of motor vehicles. In fact, several states have openly rebelled against implementing those programs within the federally mandated time frame, and Virginia has gone so far as to take the EPA to court.[2]

One area in which the imposition of strong air pollution control measures is particularly contended is the Ozone Transport Region. The OTR consists of 12 states and the District of Columbia, stretching from Virginia up the Atlantic Coast to Maine.[3] The state-level regulatory programs within the OTR are being coordinated through the Ozone Transport Commission (OTC), which was established under the CAAA. The OTC has proposed several emissions control strategies for adoption throughout the region. In particular, the OTC has asked the EPA to impose low-emission vehicle standards similar to those imposed in California, which include the use of zero-emission vehicles, otherwise known as electric cars.[4] On December 19, 1994, the EPA approved the OTC request.[5] If a majority of the states in the OTR formally approve of the plan, California-style low-emission vehicle (LEV) standards will become mandatory throughout the entire region. Additional pressure is placed on the states to accept the plan because the EPA has declared that "unless an acceptable LEV-equivalent program is in effect," states in the OTR will be out of compliance with the CAAA, which could possibly result in the imposition of federal sanctions.[6] The OTC is also promoting stringent NOx control strategies, which are more than likely counterproductive to anticipated O3 reductions.

Many cities in the OTR are subject to those air pollution control requirements because of the abnormally high air pollution levels that prevailed in 1988, in particular, high levels of urban ozone, or smog. The excess air pollution was caused, in part, by the meteorological conditions that occurred in 1988, by some accounts a once-in-100-years phenomenon akin to the disastrous 1993 floods in the Midwest. For that reason, using data from 1988 in the formulation of air pollution control requirements is misguided, according to a paper by K. H. Jones published by the Cato Institute in 1992.[7]

This study will update the findings presented in the 1992 Jones paper with a particular focus on the OTR. It will also evaluate the pollution control strategies pursued by the EPA and the OTC in the northeastern United States and elsewhere, with a particular focus on those measures aimed at automotive emissions. Finally, the study will discuss market-oriented policy alternatives to the command-and- control regime of the Clean Air Act and the potential for regulatory federalism.

Air Quality Trends in America

Despite continuing overheated claims by government officials and environmental groups about the threat posed by urban ozone, the undeniable reality is that the entire nation has experienced a dramatic and predictable improvement in urban ozone air quality. Indeed, it is difficult to identify a significant air pollution problem outside California. A broad indication of the improvement is shown in Table 1.

"Exceedances" refers to the number of times that the most highly impacted ozone air quality monitor in a metropolitan area registers ozone concentrations greater than 0.124 parts per million for one hour or more.

Table 1
Total Exceedances at Worst-Case Monitors in California and in Rest of the United States: 1985-94

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
California	257	272	270	308	233	167	185	175	128	193a
Rest of Country	188	166	275	607	101	124	155	53	104	93b
Total	445	438	545	915	334	291	340	228	232	286
Percentage in California	58	62	50	34	70	57	54	77	55	67

aLos Angeles maximum = 107 days at worst monitor. bLongest exceedances were 14 days in Houston and 7 days in Dallas.

California, in particular the Los Angeles Basin, is easily the most heavily polluted area in the United States. In 1994 the worst-case monitor in Los Angeles had 107 exceedances, 14 more than the total number of exceedances [93] for all urban areas in the rest of the nation outside California. The greatest number of exceedances in other cities in 1994 was 14 days in Houston and 7 days in Dallas. The net reduction outside California between 1985-87 and 1992-94 was 57 percent. In California the improvement was 27 percent.

Even a cursory look at the data in Table 1 reveals that the high number of ozone exceedances during 1988 was an anomaly and not an accurate indication of air quality in America's cities. Nonetheless, metropolitan areas' current attainment or nonattainment status is determined by examining a three-year data window--1988-90--that is frozen in place and does not change to reflect current air quality information.

To give an idea of how distorted the regulatory definition of nonattainment truly is, Table 2 compares the 1988-90 data window written into the CAAA with various other three- year data sets. Clearly, most of the nonattainment regions outside California easily meet federal ozone air quality standards today. Those that do not are on the cusp of attainment.

Table 2
Nonattainment Status of All Non-California Urban Areas
Number of Areas Classed as:

Period	Severe	Serious	Moderate	Marginal	Tota1
1988-90	5	11	29	40	85
1989-91	1	3	15	19	38
1991-93	0	1	12	15	28a
1992-94b	0	1	5	12	18a

aExcludes areas with design values between 0.121 and 0,124 ppm. bBased on preliminary 1994 data.

The appendix to this study examines air quality for the last 10 years (1985-94) for each of the EPA's designated nonattainment areas. The true nature of current trends is clearly evident from even a cursory examination of those data.

The EPA and the OTC argue that it is legitimate to base long-range smog reduction policy on 1988 ozone levels. The EPA has claimed that attempting to account for the meteorological conditions that caused the high number of exceedances in 1988 would be "superficial . . . premature and imprudent."[8] The OTC has maintained that to exclude 1988 in analyzing air quality trends would result in a "misleading" projection.[9] The rationale for accepting 1988 data for today's regulatory purposes is that the ozone exceedances observed that year--almost entirely a function of hot, dry weather--are by no means particularly anomalous and represent just the kind of "outer-bound" event that federal ozone rules are expected to mitigate. As an internal EPA memorandum circulated to counter the 1992 Jones study declared, "There needs to be a certain note of caution. We have had predictions of success before that did not pan out."[10]

To address that concern, we have conducted further analyses by examining 27 years of detailed day-by-day summertime temperatures for Philadelphia, an area particularly well suited to represent overall trends in the OTR. In addition to daily temperatures and calm winds, the length of high-temperature episodes is an important factor in smog formation in Philadelphia and elsewhere because high temperatures and corresponding ozone levels in the OTR are associated with multiday stagnations caused by Bermuda highs off the East Coast.

Table 3 summarizes the Philadelphia weather data. Examination of those data clearly indicates the unique meteorological circumstances that made 1988 anomalous for policy considerations. The two 18- and 22-day episodes were almost continuous in July and August of 1988. In addition, the anomalous number of 95 and 100 Fahrenheit

daytime high temperatures sets 1988 apart. As already noted, attempting to prevent one or more exceedances, equivalent to those of 1988, in a future year is like requiring that levees along the Mississippi be built high enough to prevent all possible future floods.

Table 3
(table omitted)

Notes: Only those years that experienced at least one episode longer than 10 days in length are shown. ND = no data.

The EPA has, however, acknowledged that weather can have a significant impact on ozone formation in any given year, and the agency argued that "there needs to be a careful analysis to ensure that the high levels associated with the meteorological conditions of 1983 and 1988 are past history and not lurking around the corner."[11] Interestingly, to the authors' knowledge, the EPA has yet to conduct any analysis of historical meteorological data to prove that their base-line air quality level (1988-90) is consistent with the intent of the ambient ozone standard. Although the EPA was required by the Clean Air Act to review the form of the standard, nothing has been done that would compensate for the current reliance on 1988 in the classification of ozone nonattainment areas.

Ozone Air Quality in the Northeast

The OTR was the area outside California most negatively affected by smog in 1988. Yet the progressive downward trend in all of OTR's urban areas can be seen in Table 4. Clearly, there has been significant improvement over the past few years in all but a few of the metropolitan areas of the OTR.

The final thing to note is that, given the latest available data, there are no areas in the OTR currently classifiable as "severe" or "serious" for regulatory purposes. Unfortunately, the EPA has seen to it that the 1988-

based classifications are cast in stone. One might ask, however, why we should be instituting future control measures that are required to get from a "serious" classification level to attainment when we have already dropped to a "moderate" attainment classification by doing nothing.

Table 4
Number of Areas in Each Classification: 1988-90 CAAA Classification of OTR Urban Areas and 1992-94 Data

Case	Marginal	Moderate	Serious	Severe	Total
CAAA 1990 list					
1988-90 data	23	6	6	3	38
1992-94 data	6	7	0	0	13

The average improvement over the three-year period examined in Table 4 was 15 percent, which is higher than would be predicted on the basis of calculated emission trends. If the EPA were willing to recognize the bias introduced by 1988 weather data, they would have to agree that no further controls are needed to bring most if not all of the areas listed into attainment by 1995. They obviously do not recognize that possibility.

Despite that more accurate portrayal of the problem in the OTR, a rigid set of regulatory strategies must be implemented under the CAAA. The severity of the federal regulatory mandate for any given nonattainment area is determined by examining the fourth highest ozone reading from 1988 to 1990. Depending on how high that reading is, areas are then classified as in "extreme," "severe," "serious," "moderate," or "marginal" noncompliance.

Areas designated "marginal" ozone nonattainment regions must

* maintain an inventory of all emissions sources of volatile organic compounds (VOCs) and nitrogen oxide (NOx);

* require permitted emission sources to offset their emissions at a ratio of 1.1 to 1; and

* mandate the adoption of "reasonably available control technology" (RACT) for sources in nine specified indus- trial categories emitting at least 100 tons of VOCs per year (what constitutes a "reasonably available control technology" is determined by the EPA).

Areas designated "moderate" ozone nonattainment regions are further required to

* force permitted emission sources to offset their emissions at a ratio of 1.15 to 1;

* mandate the adoption of RACT for sources in all industrial categories emitting at least 100 tons of VOCs per year;

* ensure a 15 percent reduction in VOC emissions from a defined category of sources within 6 years;

* adopt a basic automobile inspection and maintenance program;[12] and

* require vapor recovery systems to be installed at all gas stations.

Areas designated "serious" ozone nonattainment regions are further required to

* force permitted emission sources to offset their emissions at a ratio of 1.2 to 1;

* mandate the adoption of RACT for sources in all industrial categories emitting at least 50 tons of VOCs per year;

* ensure a 15 percent reduction in VOC emissions from a defined category of sources within 6 years and a 3 percent annual reduction of VOC emissions beginning in 1996;

* adopt an enhanced automobile inspection and maintenance program including increased waiver thresholds (i.e., $75 for pre-1981 cars and $200 for post-1981 cars);[13]

* mandate the use of enhanced monitoring technologies and practices on all regulated ozone sources;

* implement the federal "clean-fuel" program that requires automotive fleets to include increasing percentages of alternative-fueled vehicles;

* adopt transportation control measures if the number of vehicle miles traveled in the area is greater than projected; and

* prepare contingency measures if the area does not achieve required VOC reductions.

Areas designated "severe" ozone nonattainment regions are further required to

* force permitted emission sources to offset their emissions at a ratio of 1.3 to 1;

* mandate the adoption of RACT for sources in all industrial categories emitting at least 25 tons of VOCs per year;

* require the use of reformulated gasoline in all regional vehicles;

* adopt NOx emission control technology guidelines stipulated by the EPA;

* mandate VOC emission controls on public activities and consumer products;

* promulgate RACT controls on marine vessel loading activities; and

* establish monetary sanctions of $5,000 per ton for noncomplying sources.

Finally, areas designated "extreme" ozone nonattainment regions are further required to

* force permitted emission sources to offset their emissions at a ratio of 1.5 to 1;

* mandate the adoption of RACT for sources in all industrial categories emitting at least 10 tons of VOCs per year; and

* require clean fuels or advanced control technology for industrial boilers emitting more than 25 tons of NOx per year.

Given the current trend of improving air quality in the OTR and, for that matter, across much of the United States, it is difficult to justify those federally imposed requirements.

How Much More Regulation Is Necessary?

Up to this point we have discussed only the historical observed trends in the ozone levels in the OTR. Readers are referred to the previous Jones study for a detailed discussion of how to rationally adjust data for the meteorological influence.[14] In that analysis, the temperature-adjusted trends for the four most highly affected urban areas in the OTC were developed. Data over the past 10 years for those areas--Washington, D.C., Baltimore, Philadelphia, and the New York-New Jersey-Connecticut metropolitan region--are shown in Figure 1. They are shown in relationship to the 2005 attainment time table as projected by the OTC.

Figure 1
Temperature-Adjusted O3 Trends in Four OTR Urban Areas
[Graph Omitted]

From an empirical perspective, given the knowledge that total VOC emissions are likely to drop by 20 percent or more in those areas as the result of the ongoing auto fleet turnover to cleaner cars, one might conclude from the data in Figure 1 that attainment is likely with no further regulatory action.[15] It appears that if past trends continue, the individual trend lines will intercept the federal air quality standard well before 2005. On the other hand, some people have argued that the trend probably will not continue because of growth in vehicle miles traveled per automobile. Yet that concern is ill founded because, for most vehicles, the majority of emissions occur, not while the vehicle is on the road, but when it is initially started.[16] Unfortunately, so-called cold-start data have not been adequately modeled for policy purposes.

Still, the proper test for which of several projections is correct is to compare historical emissions and ozone trends with the models offered. Attainment for various urban areas within the OTC should be projected by examining the historical relationship between air quality and emissions--in this case, VOCs. Figure 2 shows that information for the New York-New Jersey-Connecticut region. VOC emissions data were obtained from data and reports provided by the New York Department of Environmental Conservation. The ozone data are from the most highly impacted monitor downwind of the regional urban core (i.e., Stratford, Connecticut). The ozone air quality data are adjusted for temperature.

Figure 2
Trends in VOC Emissions and O3 Design Values for the New York-New Jersey-Connecticut Region, 1980-2005
[Graph Omitted]

The correlation is evident. The annual ozone improvement of 4.4 percent per year is close to the estimated annual VOC reduction (i.e., 4.3 percent per year). The Stratford, Connecticut, ozone improvement rate has been collaborated by the research of S. T. Rao, who has derived a similar ozone reduction rate.[17] If the current design value for the Stratford site is normalized for meteorologic variation, only a 7.5 percent further VOC reduction is required to meet the federal standard and achieve attainment, a reduction that could be achieved with less onerous policies than those required or promoted by the EPA. Given that the continued turnover of the auto fleet even with moderate growth will be substantial, attainment will likely occur within a few years without any further regulations.

The Clean Air Act should at least be modified to align regulatory policy with regulatory need. Absent reform, states should evaluate the regulatory strategies mandated by the CAAA and adopt only those that cause the least disruption to the economy, such as measures to reduce evaporative emissions (by controlling fuel volatility) and remote sensing or other on-road, targeted vehicle emission reduction programs. Yet even those regulations are undesirable. Most of the

mandates are completely unjustifiable and should be rejected. Finally, affected states should petition Congress for redress.

Redesigning the Car--Again

Regrettably, rationality has not prevailed in many states, and the EPA has been asked to consider imposing additional LEV standards in the northeastern United States. On February 1, 1994, the OTC voted nine to four to recommend that the EPA force the 12 states and the District of Columbia that make up the OTR to adopt California's stringent emission standards for new automobiles, including a requirement that automakers begin selling electric vehicles.[18] The EPA approved the request, in part, because the agency explicitly "rel[ied] on the OTC's technical analysis and response to comments" in arriving at its decision.[19] However, the EPA has also hedged its bets, declaring that it would accept competing emissions proposals, such as the one of the auto industry, which would impose new emission requirements in every state but California.[20]

The OTC proposal has been highly controversial, and with good cause. There is little reason to believe that the imposition of yet another round of new vehicle emission standards will reduce air pollution in an efficient, cost-effective, or equitable manner.

The OTC proposal is relatively straightforward. Beginning with the 1999 model year, "no corporation, person, or other entity shall sell, import, deliver, purchase, lease, rent, acquire, receive, or register" a new passenger car or light-duty truck that does not conform to those vehicle categories certified by the California Air Resources Board. Those vehicle types are California Tier I vehicles, Transitional Low-Emission Vehicles (TLEVs), LEVs, Ultra-Low Emission Vehicles (ULEVs), and Zero Emission Vehicles (ZEVs). It should be noted that electric cars are the only vehicles currently capable of meeting the ZEV standard. In addition, American automakers contend that the only vehicles likely to be capable of meeting the ULEV standard will run on alternative fuels such as compressed natural gas.

According to the OTC proposal, "Manufacturers may choose any combination of [these five] vehicles . . . to meet a prescribed fleet emission average standard in the OTR."[21] The fleet emissions average that automakers will be required to meet are given in Table 5.[22]

Those fleet emission average standards are identical to those proposed in California. The only difference between the OTC LEV proposal and the California LEV proposal is that in California ZEVs must constitute a set percentage of new cars sold throughout the state--2 percent in 1998, 10 percent in 2003--whereas there is no such explicit mandate in the OTC proposal.[23]

The sales mandate for ZEVs may not be explicit, but it is clear that adoption of the OTC proposal will result in the sale of electric cars in the northeastern United States; it will be difficult, if not impossible, for automakers to meet the standards without them, particularly in the later years of the mandate. Consider the emissions of the five vehicle types outlined by the OTC given in Table 6.

Table 5
OTR Fleet Emission Standards, 1999-2003

Hydrocarbons per Model Year	Mile (gram)
1999	0.113
2000	0.073
2001	0.070
2002	0.068
2003	and beyond 0.062

Table 6
Vehicle Emissions in the OTR

Hydrocarbons per Vehicle Type	Mile (gram)

1994 standard	0.250
TLEV	0.125
LEV	0.075
ULEV	0.040
ZEV	0.000

Given those vehicle types, the California Air Resources Board (CARB) expects that, in order to meet the standard in 1999, 73 percent of vehicles sold will be LEVs, 2 percent will be ULEVs, and 2 percent will be ZEVs; in 2001 it expects 90 percent will be LEVs, 5 percent will be ULEVs, and 5 percent will be ZEVs.[24] Other combinations are possible, but avoiding the forced displacement of gasoline-powered vehicles is not. That is a point that the OTC has explicitly, and proudly, acknowledged. The OTC claims that "the program will require the advancement of technology for cleaner cars, including Zero Emission Vehicles (ZEVs)," and that ZEVs "are responsible for more than a proportionate share of the LEV program benefits because they are not subject to emission control malfunctions and deterioration as they age."[25] The OTC has also defended adoption of the California standards on the grounds that "the development of electric vehicles and other alternatively-fueled vehicles" will help address "energy security."[26]

While the OTC and some environmental groups are enthusiastic about the prospects of adopting the California vehicle standards in the northeastern United States, it is unlikely that their imposition will provide significant emission reductions in a timely, cost-effective, or equitable manner.

In estimating the costs of imposing LEV standards, "the OTC has relied upon the cost-effectiveness and emission reduction estimates of CARB for its technical support. . . . The OTC continues to rely on LEV cost estimates forecasted by CARB."[27] CARB's estimates have routinely been among the lowest offered. For instance, CARB estimates that meeting the LEV standard will impose marginal costs of less that $150 per vehicle, and that ZEVs will impose marginal costs of less than $1,500 per vehicle.[28]

Analysts at Sierra Research and elsewhere have highlighted serious flaws in CARB's estimates, such as the claim that "the LEV program continues to afford the greatest emission reduction at least cost."[29] Even the EPA begs to differ on that point, noting that enhanced inspection and maintenance are "seven times more cost effective than more stringent new car tailpipe standards."[30] Although there are reasons to doubt the EPA's claim about enhanced inspection and maintenance, CARB does not share those doubts. CARB's estimate is, rather, an example of misleading overstatement.

One of the most serious flaws in the CARB estimate is the fact that CARB counted only half of the cost of the vehicle modifications that it believes will be required. Because LEV standards are presumed to have other emissions benefits, such as the reduction of air toxics, only half of the cost was used in CARB's cost-effectiveness estimate. The other half was used to estimate the cost-effectiveness of controlling emissions of air toxics.[31]

Sierra Research has raised two other concerns: (1) that CARB underestimates the extent to which engine and emissions control changes will be necessary to meet LEV standards and (2) that "CARB's estimates for the retail cost of engine and emission control system changes . . . are lower than the uninstalled cost of components according to parts suppliers" and therefore are unlikely to have included the costs of "engineering, facilities, tooling, assembly labor, overhead, and dealer markup."[32] Other analyses, such as those performed by the Radian Corporation and the Mid-Atlantic Universities Transportation Center, also suggest that the CARB cost estimates on which the OTC relies understate the negative economic impact of implementing the LEV standards.[33]

As would be expected, American automakers have produced far higher estimates of the cost of meeting the LEV standards--estimates 5 to 20 times higher than CARB's.[34] A spokesman for the American Automobile Manufacturers Association estimates that imposing California-style standards in the Northeast will raise the average car price by $2,800.[35]

There are reasons to question the estimates of both CARB and the auto industry. As a regulatory agency, CARB has an interest in downplaying the cost of its regulations; as a regulated industry, automakers have an interest in exaggerating regulatory costs.

A more plausible set of costs for the adoption of California's vehicle emission standards was developed by Sierra Research, in conjunction with Charles River Associates. Those estimates were based on surveys of the current costs of producing the necessary pollution control equipment; the estimates were adjusted downward to account for the learning curve and productivity improvements over time.[36] As a result, Sierra Research estimates that meeting the LEV standard will cost approximately $775 to $1,000 per vehicle, and meeting the ZEV standard will cost $12,500 to $21,000 per vehicle.[37] Given the projected sale of 3 million automobiles in the OTR in 1999, adopting California-style LEV standards could impose upwards of $3 billion in costs each year. That cost estimate is far higher than the one relied on by CARB and the OTC.

Going Electric

Because so much attention has been focused on the emissions reduction potential of electric vehicles, it is worthwhile to examine the current state of electric vehicle technology and its potential to play a significant role in providing for the transportation needs of individuals. If, at present, electric vehicles are not capable of satisfying consumer demands for inexpensive, versatile, and convenient transportation, mandating their use to any degree will entail significant costs, both economic and other, to consumers.

Many environmental activists are staunch proponents of electric vehicles. And, to be sure, electric cars have much to commend them: they are quiet, need comparatively little maintenance, and have low marginal operating costs. Moreover, current electric car models can easily exceed highway speed limits and can accelerate reasonably quickly.[38] Right now, however, electric cars often lack many features and capabilities that consumers have come to expect, and they come at a price that most consumers are unlikely to be willing to pay.

The greatest concerns about electric vehicles center around the limitations of existing battery technologies. For decades engineers have promised an imminent breakthrough in battery technology that would turn electric cars from interesting auto show displays to practical everyday cars. To date, however, battery technology is unimpressive, and the cost is significant. A battery pack can cost $10,000 all by itself, and it must be replaced after several years of use.[39] The typical range for an electric vehicle on a single charge is approximately 100 miles. Using electric features, such heaters and windshield wipers, in the vehicle while driving will shorten the range. Without the installation of special equipment, recharging takes several hours, if not overnight.[40] The need to recharge may not be a significant inconvenience for the operator of a commercial delivery van or a commuter in a multicar household, but the limitations of electric vehicles prevent their ready use for weekend getaways or business trips, let alone a cross-country vacation. More important is the sacrifice of versatility. The benefits of electric vehicles will be no consolation for the family that needs a vehicle for a late-night medical emergency and discovers that the car is still charging.

Another concern raised about electric vehicles is their ability to operate in the cold temperatures of the Northeast. CARB has already had to deal with the issue of internal heaters for vehicles in the colder parts of northern California; in 1993 CARB issued a waiver that allows electric vehicles to come equipped with heaters that burn gasoline or diesel fuel, and thus produce some emissions, albeit a tiny amount.[41] The alternative is not appealing. Electric cars often cannot spare the power to operate effective defrosters, air conditioners, and other features that many drivers take for granted.[42] "In any electric vehicle, using headlights, wipers, radio, or defrost saps the battery and shortens the driving range."[43] More important, some people are concerned that freezing temperatures will sap the power of electric car batteries and reduce the versatility of those vehicles in winter even further. Lead-acid batteries, for example, can lose as much as half of their energy- storage capacity in extreme cold.[44]

Unless those and other difficulties with electric cars are overcome, it is unlikely that those vehicles will be accepted by a significant portion of the car-buying public, and any attempt to force them on consumers will require significant cross-subsidies or other inducements. Such inducements would have to be sizable because electric cars are still tremendously expensive--far more expensive than their gasoline-powered counterparts. The price differential is typically $10,000 or more.[45] Thomas Austin and James Lyons of Sierra Research estimate that the price premium for electric vehicles will be up to $21,000; the American Automobile Manufacturers Association's estimate is even higher.[46] Based on the Sierra Research estimate, imposing the California electric car mandate in the Northeast could cost $6.1 billion.[47] "If the high-end estimates are true, then a ZEV mandate represents an enormous subsidy for a fledgling industry with uncertain environmental benefits," according to Dan Dudek and Joseph Goffman of the

Environmental Defense Fund.[48]

If there is some form of electric vehicle sales mandate--whether formal, as in California's regulations, or informal, as in the OTC proposal--it is likely that the purchase of electric cars will need to be subsidized by price increases for other cars in order for manufacturers to comply. The net impact will be an average per vehicle price increase in the neighborhood of $1,000 or more. All car buyers will pay more so that a few may drive around in battery-powered buggies.

The lack advances in of electric cars is not due to lack of effort. Electric cars have been investigated since the turn of the century. Indeed, over a third of the cars purchased in 1900 were electric.[49] There were even charging stations in some areas to facilitate long-distance travel. However, gasoline-powered vehicles soon dominated the automobile market because of the increased convenience and range that they provided. Until electric vehicles have similar characteristics, they are unlikely to progress beyond niche markets, such as commercial fleets (particularly delivery vehicles and the like) and auxiliary vehicles for multivehicle families.

It is also important to recognize that the characterization of electric vehicles as "zero-emissions" is misleading. No emissions will come out of any tailpipe, but there will be emissions associated with electric vehicle use. Electric vehicles must get power from somewhere, and that often entails drawing power from utilities that burn coal or fuel oil and thereby produce emissions--emissions that have also been the subject of air pollution regulations. One preliminary EPA study found that the air quality benefits could be negligible, or even negative, depending on the source of the electricity used to charge the battery.[50] The net air quality benefits of electric cars are largely dependent on the location and energy source of the electric utility from which the recharge power is drawn. While it is unlikely that electric car use would result in a net increase of any emissions, it is possible that adoption of electric car mandates could reduce emissions in one area at the expense of another.

A final environmental concern raised with electric cars is the disposal of the batteries. Lead-acid, nickel-hydride, and other battery constituents will likely require disposal as hazardous wastes. Given the need to replace those batteries every few years, encouraging the introduction of electric cars may simply be substituting one environmental concern for another.

LEV Tailpipe Emissions and the Regulatory Limbo Stick

The goal of mandating LEVs and encouraging the purchase of electric vehicles is to reduce pollution levels in the northeastern United States. It is questionable whether yet another round of vehicle emission standards would achieve that goal quickly and efficiently. Even before the vehicle emission standards imposed by the CAAA, new cars rolling off the assembly lines were over 90 percent cleaner than those produced in 1968.[51] Cars manufactured under the latest federal standards, which took effect in 1994, are over 96 percent cleaner.[52] The reality is that there is little to be gained from squeezing a few more emission reductions from new vehicles. To illustrate that point, consider the data in Table 7.[53]

It is also important to recognize that the emission reduction benefits that the plan will provide will not materialize in the immediate future. The program does not come into effect until 1999, and the lowest emission standards do not kick in until 2003--after the attainment deadlines for some areas in the OTR. "This schedule for the LEV program will not generate reductions in time to assist areas in meeting a moderate area [standard in] 1996 and will generate only minimal reductions by the serious area 1999 attainment deadline," according to the EPA.[54] The LEV program will be most helpful in "severe" nonattainment areas, yet only the Philadelphia, Baltimore, and New York City nonattainment areas are officially classified as "severe."

Table 7
Historical Vehicle Emission Standards

Year	Hydrocarbons per Mile (grams)
Precontrol	10.60
1968	6.30

1970	4.10
1972	3.00
1975	1.50
1980	0.41
1994	0.250
1999(Calif.)	0.113
2003(Calif.)	0.062

Because near-complete fleet turnover will not occur for an additional decade, it will take several more years for TLEVs, LEVs, ULEVs, and electrics to make up a majority of the automotive fleet (assuming of course that the turnover process is not slowed by higher car prices). Nonetheless, in approving the OTC plan, the EPA declared that "unless an acceptable LEV-equivalent program is in effect, EPA is today finding the OTC LEV program necessary to achieve timely attainment."[55] That claim is insupportable, even according to the EPA's own prior analyses.

Of course, since the LEV standards will result in higher prices for consumers, one would expect that it would reduce the number of new vehicles sold and thereby mitigate or delay the OTC proposal's benefits.[56] Emissions control standards have already had their effect on car prices. According to the Wall Street Journal, for the average American worker, the average number of weeks of work required to purchase the average new car increased over 35 percent between 1979 and 1989.[57] Those price increases have most likely encouraged car owners to keep their cars for a longer period of time, and indeed the average age of passenger vehicles increased by approximately one-third between 1974 and 1989.[58]

Nonetheless, the OTC estimates that adopting a California-style LEV program will reduce hydrocarbon emissions by up to 63 percent and nitrogen oxide emissions by up to 39 percent. Those estimates, for reduction levels once the program is completely in place (at least a decade after 2003), are unduly optimistic. Other studies, such as those conducted by the Radian Corporation and the Mid-Atlantic Universities Transportation Center, predict far more modest results. Those studies estimated hydrocarbon emission reductions of from 7.6 to 10.7 percent and nitrogen oxide reductions of 8.5 to 15.1 percent by the year 2015.[59] As the Radian analysis concluded, "Since modest emission reductions are estimated from the LEV program when realistic assumptions are used to model its benefits, it is unlikely that adopting this program will significantly impact ozone levels in the Ozone Transport Region."[60] Indeed, vehicle emissions standards imposed in the past were of far greater magnitude and "have been less successful than expected."[61] There is no reason to expect optimistic scenarios of the OTC's proposal to be any more accurate predictors of future reductions.

Advocates of tighter vehicle emission standards point out, correctly, that average vehicle emissions are substantially higher than current new vehicle standards. "Minor malfunctions in the emission control system can increase emissions significantly, and the average car on the road emits three to four times the new car standard," according to the EPA.[62] Emission standards are imposed, but many cars exceed the standards.

Excess emissions are not distributed uniformly. The EPA acknowledges that "10 to 30 percent of cars are causing the majority of the vehicle-related pollution problem."[63] Indeed, studies suggest that 10 percent of the vehicles may be responsible for 50 percent or more of hydrocarbon emissions.[64] That means that 1 of every 10 vehicles on the road can produce as much pollution as the other 9 combined. Therefore, attempting to address air pollution by imposing tighter emission standards on new vehicles is not likely to produce significant results. As a review in Science concluded, "The key to the vehicle emissions problem is the inordinately large contribution to emissions from a relatively small fraction of the fleet, the super emitters."[65] Equally important, the majority of vehicles on the road contribute insignificantly to pollution. According to a study conducted for CARB, "Half the vehicles measured only contributed 2 percent of the total on-road carbon monoxide emissions and 10 percent of the hydrocarbons."[66] Those vehicles simply do not emit enough to be of significant environmental concern.

Many people assume that most of the "super emitters" are older vehicles. That, too, is a misperception. Recent research is fairly conclusive: "The high emitter problem appears to span all model years and results from dirty vehicles

that are driven significant distances."[67] As Douglas Lawson, of the Desert Research Institute and formerly of CARB, has observed, "Relatively little pollution comes from old cars, because there are few of them on the road."[68] There are more new cars on the road, and newer cars are driven more often, and therefore the dirtiest of new cars--typically cars with malfunctioning emission control equipment--are the primary culprits behind excess vehicular emissions. Moreover, on-road testing in California has found that "emission control equipment in late model, high-technology vehicles continues to be subject to modifications (tampering) that have always been exhibited in the motor vehicle fleet."[69] Comparisons of vehicle fleets with differing emissions technologies and maintenance rates suggest--and on-road studies strongly suggest--that "the effects of broken emission control equipment are greater than the effects of age, technology, or mileage."[70]

Consequently, identifying and repairing or retiring the dirtiest vehicles in the automotive fleet will probably be more effective at reducing automotive emissions than a new round of vehicle emission standards. Yet most current and proposed policies ignore that possibility.[71] Moreover, by targeting emissions reductions in that manner, pollution control policies will also be more equitable. Making the polluter pay imposes costs on individuals and firms in proportion to their contribution to the problem. "Drift-net" strategies, such as new car standards, clean fuel mandates, and the like, impose costs on all car owners irrespective of their relative contributions to nonattainment problems.

As evidence that targeting the heaviest polluters for emissions reduction can provide significant reductions in emissions, consider that in major cities the percentage of vehicles whose emission control equipment has been tampered with or is malfunctioning is estimated at 11 to 25 percent.[72] The majority of those vehicles will be in the dirtiest quintile of the automotive fleet. Using the conservative assumption of an 11 percent tampering and malfunction rate, if only half of those vehicles are identified and repaired so that they emit the fleet average, a city would achieve a vehicular hydrocarbon emission reduction of over 15 percent in its first year--an emissions reduction greater than that projected for the LEV program in the year 2015. Because many of those vehicles are high NOx and carbon monoxide emitters, such a program would deliver emission reductions for those pollutants as well. A more successful program (or a greater tampering and malfunction rate) would result in even greater reductions. Indeed, cleaning up the entire dirtiest quintile of motor vehicles to the fleet average would produce emission reductions of nearly 40 percent.

The AAMA Alternative

The American Automobile Manufacturers Association has strongly opposed the OTC LEV plan. The AAMA even sued the states of New York and Massachusetts over their decision to impose California standards even if the rest of the OTR states do not. In place of a California-style LEV standard in the Northeast, the AAMA has come up with a LEV plan of its own, known as the Federal Low-Emission Vehicle proposal, or "Fed LEV."[73] The auto industry has lobbied hard in support of the Fed LEV plan and has received a sympathetic ear from the EPA as well as officials in several states. Although the EPA has given the go-ahead to states in the OTR to implement the OTC plan, the agency has also expressed its preference for a plan along the lines of the Fed LEV plan, because such a plan will affect new cars in every state save California, not just those in the OTC region. The agency has declared that "EPA believes that a LEV-equivalent program could provide far greater environmental and public health benefits to the [OTR] and the nation, and do so more efficiently, than would the OTC LEV program."[74]

The AAMA proposal is essentially a plan to accelerate the introduction of a new generation of LEVs nationwide before the EPA is allowed to impose such a national standard. Under the Fed LEV proposal, beginning in 2001, 30 percent of new cars sold would meet a new federal LEV standard close to the California standard for low-emission vehicles. All new cars would meet the new standard by 2003. The Fed LEV plan has no provisions for the introduction of ULEVs or ZEVs; however, the automakers claim that electric vehicles "would be made available as they become commercially feasible."[75] The Fed LEV proposal would apply to all states except California.

The AAMA claims that "the air quality benefits will be virtually the same under the Fed LEV proposal" as under California standards.[76] At least one independent analysis, conducted at Johns Hopkins University, supports that conclusion. That study held that a California-style LEV plan will produce "relatively small reduction benefits over competing strategies" including the AAMA plan.[77] The OTC disagrees: "The California LEV program would deliver considerably more emission reduction benefits in the OTR than the proposed industry program."[78] Moreover, the OTC prefers its LEV plan because it will also promote "energy security" and spur the growth of an electric car

industry, though why those matters are the concern of the OTC is far from clear.[79]

The AAMA proposal will not produce the full level of emissions reductions that the OTC LEV plan will, and the program begins two years later. Yet the difference may not be that substantial. As already noted, the OTC plan is not one that the northeastern states should voluntarily adopt or that the EPA should impose if the primary consideration is achieving emissions reductions in a cost-effective and equitable manner. Measured from that standpoint, Fed LEV is a more moderate version of the proposal that imposes fewer costs and provides fewer benefits but has the same fundamental flaws.

The Fed LEV plan has the additional problem of being a national standard, rather than a program focused on areas that the EPA has classified as in nonattainment. As a result, much of the cost associated with the program will be squandered. Car buyers in 49 states would purchase cars that are cleaner--and more expensive--than necessary to achieve suitable air quality. There is absolutely no reason why individuals in rural and metropolitan attainment areas should have to purchase higher priced LEV vehicles.

The advantage to the automakers is that under the plan they will sell the same vehicle in all non-California markets, and a single vehicle standard will be easier to meet than a fleet emission average that incorporates several vehicle standards. That producer convenience will come at the expense of the consumer. In addition, it is possible that American automakers see the implementation of a LEV standard that they propose (and are presumably prepared to meet) as a way to gain comparative advantage vis-Ö-vis their foreign competitors. Here again, American automakers would benefit at the expense of American consumers. That is not a worthwhile trade-off.

Regulatory Sticks for All Seasons

Several state air quality officials have claimed that additional measures beyond the recommended LEV program and those controls mandated by the CAAA will be necessary to satisfy the EPA; the OTC believes "that the control strategies specifically mandated in the Clean Air Act would not be sufficient for the nonattainment areas in the OTR to achieve and maintain the ozone National Ambient Air Quality Standard (NAAQS)."[80] However, given current ozone trends, if attainment of the air quality levels embodied in federal air quality standards were the primary concern, much of the OTR could do without LEV standards and other expensive pollution control programs. However, the EPA does require further emission reductions to fulfill statutory obligations under the CAAA.

Among the measures that are under consideration are enhanced vehicle inspection and maintenance (known as "enhanced I&M" or "IM240") and various trip reduction measures, such as the employee commute option, designed to reduce the number of vehicle miles traveled. Both of those programs are mandatory in parts of the OTR. Enhanced I&M in particular is required in all urban areas in the OTR with a population of 100,000 people or more. Both approaches are flawed for many of the same reasons that the LEV program does not represent a sensible emission control strategy: they fail to target the greatest sources of emissions for reductions. An additional control measure that is likely to be imposed on much of the OTR is further regulation of NOx from stationary sources. That, too, is a policy that will fail to produce significant air quality improvements.

Enhanced Inspection and Maintenance

All urban areas in the OTR with 100,000 or more people are required to implement enhanced inspection and maintenance programs. Such programs are "an integral part of the effort to reduce mobile source air pollution," according to the EPA.[81] I&M programs require that all vehicles in a given area have their emissions tested periodically, typically every year or every two years. Many cities in the OTR already have I&M programs of some kind in place.

Enhanced I&M essentially involves the imposition of a more intricate, lengthy, and expensive test than is currently used. The EPA model of enhanced I&M is known as "IM240" because it is a 240-second test that examines vehicle emissions under a variety of driving conditions and also tests evaporative emissions through what is called a purge-and- pressure test. The necessary equipment for that test is three to nine times more expensive than existing I&M testing devices.[82] The EPA estimates that if implemented properly, enhanced I&M could result in a whopping 28 percent reduction of hydrocarbon emissions.[83] The OTC sites LEV standards as the most cost-effective emission

control strategy, noting that the "EPA has stated that 'enhanced' or 'high-tech I/M' is the most effective air pollution control program it has identified."[84]

Because IM240 is a longer and more expensive test, costs to vehicle owners would certainly increase. In addition, because most cars are expected to pass even an enhanced I&M test, all vehicle owners are forced to bear costs in terms of both time and money to identify and clean up the emissions of a select few. Moreover, Lawson has found that over half of the potential emission reductions come from only a small fraction of those vehicles that fail stationary I&M tests.[85] That is why periodic I&M programs represent a drift-net approach to emission control--any emission reductions achieved by the program result from its scope rather than its efficiency.

However, there are serious questions about the additional air quality benefits to be gained from the test. As on-road tests and random pullovers have found, many high- emitting vehicles are passing even fairly advanced I&M tests.[86] The General Accounting Office reported, "Our review of EPA data found that over 25 percent of the vehicles the EPA tested using the IM240 test procedure failed an initial emissions test but passed a second emissions test, even though no repairs were made to the vehicles."[87] If heavily polluting vehicles cannot be more accurately diagnosed and repaired with IM240, then its usefulness as a pollution control strategy is severely limited.

The EPA claims that implementing enhanced biennial I&M will significantly reduce the costs of the program with a minimal loss in the emissions reduction potential of the program.[88] However, empirical evidence suggests that such is not the case. For instance, a pilot roadside inspection program conducted for CARB found that approximately half of the vehicles on the road had emissions exceeding the standard the I&M program was to enforce and a significant proportion of those vehicles had been tested recently.[89] Another study found "an overall failure rate of 42 percent for all the cars that were stopped in the roadside survey within 90 days of their scheduled smog check test."[90] If tests are required less often, malfunctioning vehicles will, on average, have high emission levels for far longer periods before they are identified. That cannot but reduce the efficacy of the EPA program.

Part of the problem is that heavily polluting vehicles often have highly variable emissions. Therefore, those vehicles "are likely to exhibit large test-to-test emissions variability. Variable-emission vehicles (flippers) may be as few as 4 percent of the fleet, but they can contribute more than 20 percent to overall tailpipe emissions."[91] That has serious implications for the potential effectiveness of enhanced I&M programs. As Lawson notes, "As long as there are vehicles with emissions variability on the road, any I/M program that relies upon scheduled testing is likely not to be very effective."[92]

A particularly controversial element of the EPA's guidelines for enhanced inspection and maintenance programs is the requirement that emission testing occur at a centralized location separate from where high-emitting vehicles are to be repaired.[93] Several states, including California and Virginia, have challenged the necessity of that requirement, charging that it unnecessarily adds to the cost of I&M programs without providing significant emission reduction benefits.[94]

The EPA justifies the requirement with the argument that separating test and repair is necessary to reduce the likelihood of fraud. If testing and repair occur at the same location, it is argued, car owners may bribe attendants to pass heavily polluting vehicles. "Experience has shown that quality control [of vehicle inspections] at test-only stations is usually much better," according to the EPA.[95] Some environmental groups have supported that argument. Under decentralized systems before the CAAA, "service station owners could enhance the goodwill of customers by passing cars that should fail; they also had no incentive to provide quality repairs for the cars they did fail, because no outside body tested the cars after they were repaired," notes David Driesen, senior project attorney at the Natural Resources Defense Council.[96]

Those arguments sound plausible. However, the empirical data on the effectiveness of various I&M programs fail to support the conclusion that centralized systems that separate test and repair provide significant emission reduction benefits over decentralized programs. As a recent RAND Corporation report found, "Existing national data, limited as it is, suggests little difference in measures of effectiveness between centralized and decentralized I/M programs. Thus there is no empirical basis to choose between program types."[97] The conclusion is based largely on analyses of the EPA's own tampering surveys.[98] Nonetheless, the EPA views centralization of testing, separate from repair, as a

necessary component of enhanced I&M programs.

It is known that tampering also contributes significantly to vehicle emissions. Yet according to Lawson, "It is clear that I/M programs, regardless of the type, have not made much progress toward reducing the occurrence of tampering."[99] There is little reason to believe that any announced, periodic I&M program that is developed by the EPA will fare any better; "I/M program changes that merely replace one test design with another will result in little, if any, overall emissions reduction, require large capital investment, will be costly to consumers, and may ultimately undermine public support of air pollution reduction efforts."[100] Researchers at Resources for the Future concur. "The real problems with past I&M programs--motorist tampering and the ineffectiveness of vehicle repair--are not addressed by requiring an IM240 [enhanced I&M] test."[101]

The problem is inherent to the design and frequency of such a test, not the level of technology that it uses. A more promising alternative, one that combines vehicle inspection with emissions enforcement and avoids imposing significant costs on the majority of car owners that operate clean vehicles, remote sensing, has yet to be seriously explored by the EPA.[102]

Only recently has the EPA responded to such criticism and proposed easing the stringency of its I&M guidelines. At this writing, the EPA is proposing a "second, less-stringent, enhanced I/M performance standard" that some states will be allowed to use.[103] Yet even that proposal stops far short of allowing states to implement more cost-effective and equitable vehicle emission control strategies.

Terrible TRMS

One of the more burdensome and least cost-effective elements of the CAAA is the requirement that nonattainment areas implement trip-reduction measures, known as TRMs. The idea behind TRMs is to reduce emissions by reducing the number of vehicle trips made each day, particularly those made by commuters.

TRMs are typically inexpensive (to government agencies) and ineffective, in part because they tend to be voluntary programs. Public education campaigns, such as those undertaken in some cities that encourage voluntary no-drive days and preach "Don't drive, one-in-five" have a minimal impact because commuters are loathe to give up the benefits of using in their automobiles. Now, however, some areas within the OTR will make TRMs mandatory and force corporations to participate in efforts to wean their employees from solo commutes.

The basic mandatory TRM program is known as the employee commute option (ECO). That requirement forces companies with 100 or more employees to "reduce work-related vehicle trips and miles traveled by employees."[104] All regulated employers must increase their "average passenger occupancy per vehicle (APO) in commuting trips between home and the workplace . . . to a level not less than 25 percent above" the average for that region.[105] ECO is a required measure in areas designated by the EPA as "serious" ozone non- attainment areas. In the OTR those are the Baltimore, the Philadelphia-Wilmington-Trenton, and the New York City-Long Island metropolitan areas.

Employers are responsible for the implementation of the program at their own expense. That can entail appointing an in-house transportation coordinator to oversee ECO's implementation and report results to local regulatory agencies, as well as paying "administrative fees" to local agencies for the processing of ECO information.[106] Under the ECO program, employers are the "designated 'enforcers'"[107]-- because that makes the program easier to enforce and because it creates a middleman between regulatory agencies and those affected by the program.

Estimates of ECO's emission reduction potential are extremely modest. Optimistic estimates are that ECO could reduce emissions by 5 percent, but the General Accounting Office reports that "transportation planners generally expect" that programs such as ECO will reduce emissions less than 1 to 3 percent. The GAO suggests that such programs should be viewed as having a "modest but complimentary role."[108]

One reason for the limited effectiveness of that type of approach is the fact that home-to-work commuting represents only one-fourth of vehicle trips, and that percentage is declining.[109] Moreover, "only 14 percent of the vehicle miles traveled during the morning rush hour is to employers of 100 or more people."[110] Even if all employers were covered by the ECO program, the approach would still not be comprehensive. Recent studies found that in the largest

20 cities in America, approximately one-half of the traffic during the morning peak hours and approximately two-thirds of the traffic during the afternoon peak is not work related.[111]

An additional problem with ECO and similar programs is that they do little to address the issue of cold starts. A significant portion of emissions from many vehicles occurs when the vehicle is first started--when the engine is cold and there is less efficient combustion.[112] In many areas employees will seek to meet ECO requirements by using mass transit rather than driving all the way to work. However, they will not necessarily forgo using their cars. They may simply drive to the nearest subway or train station, as is common in areas such as the Washington, D.C., metropolitan area. Thus, the overall number of trips may not be addressed, and cold-start emissions--possibly the greatest potential area for emissions reductions from a TRM program-- may not be reduced.

Covered companies will strive to meet ECO in a variety of ways, ranging from positive incentives to alter driving habits to offering flextime and telecommuting programs. In many instances, however, inducing employees to change their commuting habits will be very difficult. In New Jersey, for example, more than 80 percent of workers commute solo, and many are averse to changing their habits. Executives at Allied Signal Corporation in Morris Township, New Jersey, found that to be the case when they surveyed employees in preparation for complying with ECO. Over three-quarters of Allied Signal's employees "were not interested in such commuting alternatives as mass transit, bicycling, or walking," reported EPA Watch.[113] A survey at Shell Oil Company's Houston facility found that employees are loathe to forgo driving to work "for fear of being stranded at work in a family emergency."[114] Getting employee cooperation is also difficult for government agencies. Even the California state transportation agency has reportedly failed to attain its commuting goals.[115]

The overall trend is toward an increasing number of solo commuters. As the General Accounting Office has noted, "Americans are becoming more, not less, automobile-oriented."[116] Between 1980 and 1990, according to census data, the percentage of workers commuting alone increased from 64 to 73 percent, and the percentage using carpools declined from 26 to 18 percent.[117] The early returns from employer- based trip reduction efforts in California are hardly encouraging, despite concerted efforts.[118]

In suburban areas that are required to implement the ECO, an estimated 70 percent of workers make regular intermediate stops during their commutes, and a similar percentage runs errands during midday breaks. "To working parents, nurseries and grocery stores are daily destinations just as important as their offices."[119] That may not be a large concern in downtown New York City, but it is a very real concern in communities in Long Island, Connecticut, and northern New Jersey that are included in the New York City nonattainment area. The average vehicle occupancy for New York City is five times that of Region 4, which includes Westchester, Rockland, and Orange Counties. That reflects the different vehicle use patterns and available commuting options in urban areas and suburban areas.[120]

No matter how it is implemented, ECO will have a significant economic impact. Estimates of the direct economic costs range from $100 to $900 per employee per year, with the EPA's estimates at the low end of the range.[121] Failure to adequately comply can result in significant fines. In the New York area, the state Department of Transportation has proposed fines of one dollar per employee per day. Elsewhere, fines for noncompliance can be as high as $25,000 per violation.[122]

Fines will be set region by region, but in all cases they must be significantly higher than the costs of compliance. Total costs for the areas covered under the ECO program will likely top $1.2 billion per year, according to the EPA.[123] As states have actually begun to implement the program, the EPA has slightly modified its stance in response to corporate concerns that ensuring ECO compliance will be difficult, if not impossible, without severely imposing on employees. Both EPA administrator Carol Browner and assistant administrator Mary Nichols have indicated that sanctions will not be imposed on states that fail to impose fines when corporations have made a "good faith" effort to meet trip reduction goals.[124]

ECO will have a disproportionate impact on suburban communities that are included in urban nonattainment areas. Those communities have "the most complex commuting patterns [and] the least-developed mass-transit systems" and will be the most vulnerable to corporate flight.[125] Moreover, the ECO program provides yet another reason for companies to relocate out of nonattainment areas and into rural areas that have yet to see much economic

development.[126] Another real concern is the potential for employer liability. Given recent legal trends, it is quite possible that employer- provided or employer-subsidized vanpooling services could be viewed as an extension of the workplace. That could mean that employers would be held liable for accidents during the commute.[127] In short, there is a real danger of ECO's contributing to the ultimate trip reduction measure: putting people out of work.

Ironically, some of the same governments that will be enforcing ECO programs also enforce laws or regulations that discourage alternatives to solo automobile commutes. For example, New York City has stringent laws against private jitney services and feeder vans, even though there is ample demand for those services in many parts of the metropolitan area, so much so that many entrepreneurial individuals provide those services under threat of prosecution.[128] The prevalence of illegal van services in Jamaica, Queens, demonstrates that "mass transit cannot accommodate demands," according to E. S. Savas. The reality is that "a significant portion of the riding public eschews the buses and prefers the vans for their speed, comfort, and convenience," and suitable alternatives that meet those needs are absent.[129] The Environmental Defense Fund and other organizations have noted that the potential environmental benefits to be gained from deregulating the private provision of transportation services have not been fully explored.[130]

A related issue is the differential tax treatment of different employer-provided transportation benefits.[131] The provision of free parking is often treated differently by state and federal tax codes than is the provision of mass transit vouchers, van services, or other accommodations. That limits the ability of employers to provide various financial incentives--such as cash transportation allowances--as working-condition fringe benefits without increasing the tax burden on their employees. As one employer commented, "We're trying to get our carpools up by another 150 people and we want to provide monetary incentives. That money would be taxable and we don't want to offer incentives that are taxable so we're looking at alternatives."[132]

The different tax treatment of various employer-provided transportation benefits distorts the behavior of commuters. If all such benefits were treated equally, some commuters might opt for alternatives to driving to work. Certainly, if the federal government is intent on forcing people out of their cars during the morning commute, it should remove policies that provide incentives for driving. The Clinton administration has proposed such measures on the federal level, and similar measures should be instituted on the state and local level.[133]

Noxious NOx Control

Many states are also looking at imposing additional controls on the emission of NOx. The OTC also has made a determination that regionwide NOx control will be necessary in addition to maximum VOC control in order to attain the ozone standard by 2005. That conclusion is erroneous for three reasons: (1) It is based on regional modeling using the July 1988 episode as the base-line case. (2) It relies on a regional model that has yet to be validated or responsive to external scientific peer review. (3) The model produces results that are in direct conflict with the accepted urban ozone-VOC-NOx model according to which NOx control increases ozone levels.

The latter concern is underscored by examining the early morning ratio of VOC to NOx. If the ratio is below about 8.5 to 1.0, VOC control is necessary and NOx control is clearly counterproductive. Data provided by the New York Department of Environmental Conservation for the New York- New Jersey-Connecticut region (Table 8), as well as data analyzed by Jones for Washington, D.C., Baltimore, and Philadelphia, clearly demonstrate that NOx control is counter productive.

Table 8
HC to Nox Ratios in New York-Connecticut-New Jersey Air Quality Control Region

Median HC to NOx Ratio			
Location of Monitor	1988	1990	1992
Eisenhower Park, N.Y.	8:1	3:1	4:1
Plainfield, N.J	10:1	9:1	7:1

Newark, N.J.	8:1	6:1	7:1
Mabel Dean Bacon, N.Y.	9:1	6:1	ND

Clearing the Air in the Northeast

Given the steady downward trend of ambient ozone levels within the OTR, the OTC LEV proposal and other onerous emission control measures are particularly difficult to justify on grounds of public health or environmental protection. However, such considerations are not the driving factors behind the Clean Air Act's provisions. Cities classified as nonattainment areas are required to achieve minimum levels of emission reductions irrespective of current pollution levels or existing trends. The OTC justifies that policy by arguing, "Interpretation of continued emission reduction needs based solely on these short term trends is misleading as short term trends have historically proven inaccurate."[134] The OTC seems to argue that bad weather can require more stringent emission control programs, but good weather cannot alleviate those requirements. More important, the OTC fundamentally misreads the very trend data that it uses to justify its regulatory proposals. Nobody can examine the data shown in this study and conclude that air quality improvements are "short term trends." Indeed, the air quality trends identified by one of the authors in February 1992 have continued as anticipated.[135]

Moreover, certain emission control strategies, such as those discussed above, are encouraged or required even though more cost-effective and equitable alternatives exist.[136] Some of those possibilities include the addition of purge-and-pressure checks to existing inspection and maintenance programs in lieu of IM240, further reductions in fuel volatility to control evaporative emissions, and the use of remote sensing to identify heavily emitting vehicles with minimal cost or inconvenience to the drivers of relatively clean vehicles.[137]

Current laws and regulations make it very difficult to pursue such approaches in lieu of the programs discussed above. Neither economic nor environmental interests are served by such rigidity. A more flexible approach to meeting attainment deadlines would allow states to develop more innovative and cost-effective approaches to air pollution control. Unfortunately, that has not been the strategy pursued by Congress and the EPA.

The CAAA and their implementing regulations seem to be written so as to focus more on emission reductions for the sake of reductions than on achieving any particular level of public health protection. For example, areas that are classified as "moderate" nonattainment areas or worse must achieve a 15 percent reduction in hydrocarbon emissions by 1996, and "serious" and "severe" nonattainment areas must achieve an additional 3 percent a year thereafter until attainment is reached.[138] However, in computing emission reductions that count toward the CAAA requirements, states are not allowed to include emission reductions that result from natural fleet turnover (although those can be substantial) or "any measure relating to motor vehicle exhaust or evaporative emissions promulgated by the [EPA] administrator by January 1, 1990."[139]

Moreover, if the EPA is late in promulgating a regulation required under the CAAA, states cannot count the reductions from that future regulation as part of their implementation plans until the regulation is promulgated.[140] Those measures can combine to force states to implement more emission control programs than required to meet the level of environmental protection embodied in the federal air quality standard.

Ozone Exposure: Thresholds and Public Health

Some people may argue that such measures are appropriate because they ensure an additional margin of protection for public health. However, just as current nonattainment classifications overstate the air pollution situation in most urban areas, such arguments overstate the health impacts of current exposure to urban ozone. For example, both the EPA and the American Lung Association have overstated the nationwide exposure to urban ozone. The ALA's 1993 report, "Breath in Danger II," stated that there are 163.6 million persons residing in counties that are not in attainment.[141] The report gives the impression that that is the current exposure situation. As it turns out, the ALA used the EPA's 1991 nonattainment designations, which assumed that all counties within each urban region were in fact showing ozone levels above the standard. Yet even a cursory examination of the data reveals that that is not the case.

First, the 1991 designations were based on the 1988 drought year observations. Second, most counties within an urban

area do not reflect ozone levels measured in the most impacted downwind county. A closer examination of the data available for 1990-92, the most normal three-year period of the past decade from a temperature perspective, shows a much different picture for the five major urban areas that are the most affected by urban smog (i.e., Washington, Baltimore, Philadelphia, New York-New Jersey-Connecticut, and Boston) than that which has been presented by groups such as the ALA. The percentage of the population exposed to ozone levels above the standard was from 20 percent to 57 percent of the total population in each urban area, not 100 percent as alleged by ALA.[142]

Another, more important, parameter is the severity of the exposure (i.e., what percentage of the population in each urban area was exposed to 1, 2, 5, or 10 days above the standard). Those data are shown in Figure 3.

Figure 3 clearly paints an entirely different picture than the one presented by the ALA. Their sense of urgency about the need for a "do-everything" control policy is not borne out by the data. Finally, it must also be remembered that the current federal air standard of 0.12 ppm for ozone includes a margin of safety that provides additional protection for human health, casting further doubt on the claims that current exposures to urban ozone are a significant public health concern.[143]

Figure 3
Distribution of Pollution Exposure by Percentage of Population and Number of Days above National Ambient Air Quality Standards in Five OTR Urban Regions
[Graph Omitted--Tabular Representation Follows]

Number of Days Exposure above NAAQS 1-2 3-5 6-10 >10 Percent of Regional Population Exposed Baltimore 31.2% 8.1% 1.4% 0% Boston 25.4 0 1.2 0 Washington, DC 16.7 3.4 0 0 NY/NJ/CT 15.7 17.8 8.8 1.0 Philadelphia/NJ 26.7 21.6 6.5 3.9

Alternatives to Regulatory Centralism

The states that make up the OTR are in a bind. The air quality in most nonattainment areas is improving and can be expected to continue improving. Nonetheless, federal law requires additional emission reductions above and beyond those required to achieve attainment. Failure to draft EPA- approved State Implementation Plans can result in federal sanctions, including the loss of hundreds of millions of dollars in federal highway funds and limitations on new development--something all state governments are eager to avoid. Moreover, there are serious questions to be raised as to whether nonattainment standards based on a few one- hour measurements conducted at a handful of sites over a three-year period are reasonable and necessary to safeguard human health.

At the present time, the EPA is not required to use the most up-to-date data in determining the nonattainment status of metropolitan areas. That should change. There is no sense in imposing stringent pollution control strategies based on air quality measurements that are obsolete and fail to reflect current conditions. Table 9 indicates what the nation's nonattainment picture would look like if the most recent data were used for regulatory purposes.

Ideally, the EPA would consider the impact of meteorological conditions on pollution trends as well, since weather patterns sometimes obscure the very real air pollution gains that are being made throughout most of the country.[144] Moreover, using the fourth highest reading over a three-year period to judge how bad an area's smog problem is for the purpose of regulation is dubious. First, the reading in question is generally not representative of typical air quality in a region. Second, the use of peak concentrations for regulatory purposes tends to highlight erratic weather episodes and ignore natural meteorological variability. Analysts have suggested numerous possible alternatives. Most interesting is the average of the second highest ozone reading each year over a three-year period, which would produce a more robust and reliable standard for regulatory purposes.[145]

It is important that states and localities be given more flexibility in developing air pollution control strategies for those areas where further emission reductions are to be required. If the language of the Clean Air Act prevents the EPA from granting such flexibility, then the act should be amended.

That is an approach that some environmental organizations are beginning to appreciate. The Environmental Defense Fund recommends "moving away from a strict reliance on technology-based controls and toward a strategy of

establishing enforceable emissions responsibilities." As EDF analysts Dan Dudek and Joseph Goffman note,

Note: There were no severe areas. Design value is the fourth highest observation in three years at each monitor. The highest design value in a region in 1988-90 is the regulatory base line for classification and state implementation planning purposes. a Different site used by EPA than in previous years, or alternative site with higher design value. b Missing data rule applied by the EPA. Values in parentheses are second or third highest observations.

Table 9
Reclassification of 18 Non-California Nonattainment Areas on Basis of 1992-94 Data

Design Value (ppm)	1988-90	1990-92	1991-93	1992-94
Serious				
Houston	.220	.210	.200	.172
Moderate				
N.Y.-N.J.-Conn	.187	.148	.158	.148
Philadelphia	.187	.153	.156	.139
Atlanta	.159	.146	.149	.140
Hartford	.172	.158	.158	.141
Phoenix	.141	.141	.147	.147
Marginal				
Portland, Me.	.154	.148	.147	.127
El Paso	.150	.140	.136	.133
Washington, D.C.	.165	.134	.137	.126
Louisville	.148	.125	.130	.125
Richmond- Petersburg	.142	.122	.128	.128
St Louis	.149	.127	.132	.125
Springfield, Mass.	.167	.139	.141	.131
Dallas-Fort Worth	.140	.147	.141	.137
Baltimore	.181	.135(.156)b	.150	.133(.135)a
Boston	.165	.132	.137	.136
Baton Rouge	.168	.127	.135	.135
Chicago	.190	.143	.145	.133

For too long environmental policy has focused on specific control technologies rather than specific quantities of emissions reductions. . . . Imposing a particular technology both subverts the market's imperative of continuous innovation and shields polluters from accountability for total emissions as long as they are "in compliance" with technology standards.[146]

If emission reductions are to be required of local communities or corporations, it is far preferable for the federal government to set emission reduction requirements and see that they are met by the states or localities than it is for the federal government to play vehicle designer or commute planner for every urban community in America. Environmental innovation and the development of more cost- effective strategies are dependent on such flexibility.

The more we learn about air pollution control, the stronger the case becomes for targeting emission reductions at the greatest sources. In the case of automobiles, that means targeting the heaviest polluters before going after the relatively clean vehicles that are not contributing to the problem. That is a matter not only of economic efficiency but of simple

justice. When alternatives exist, there is no reason to impose significant pollution control costs on segments of the population that are causing insignificant harm, if any harm at all. As one observer of current air pollution policy has noted, "You wonder what the EPA wants to get rid of--pollution from the atmosphere or cars from the highways."[147]

Even if the federal government must set air quality standards, it need not mandate how the states go about meeting those standards. Different regions have different needs, and the best air pollution control strategies are going to vary from place to place.[148] States should have the flexibility necessary to identify those control strategies that make the most sense for their unique environmental situations. Many of the approaches encouraged by the federal government, such as the ECO, would not be imposed voluntarily in most parts of the country.

Reformers should not stop there. Flexibility is important not only in the determination of air pollution control strategies but also in the determination of air pollution control goals. With the imposition of the NAAQS for ozone, the federal government has preemptively defined how clean is clean enough for every region in the country. Yet there is little reason to believe that the federal standard, with its regulatory focus on the fourth highest reading over a three- year period, is better than a focus on the second highest reading, the sixth highest reading, or even the seventeenth.

The imposition of costly air pollution control strategies comes at the expense of other local priorities, such as education and health care, and higher levels of disposable income that families and individuals could use to finance a wide range of life-enhancing goods and activities. Some cities may be wealthy enough that an increase in car or fuel prices may not seem important. In other areas, natural conditions may make emission reductions beyond a certain level so expensive that individuals would rather focus on other concerns.

Although greater reliance on peer-reviewed scientific research in the establishment of environmental goals and priorities would be helpful, it will not be sufficient in and of itself. Congress and the EPA have historically been poor at prioritizing environmental goals, even when good science was available.[149] Moreover, there have been political pressures to deliberately establish unrealistic or unattainable emissions reduction goals, even in the face of political opposition.[150] Theoretically, the federal government may be capable of basing policy decisions on scientific criteria, but the history of air pollution policy-- and, indeed, of environmental policy generally--suggests otherwise.

There is a possible alternative. Rather than allow Congress to set a "one-size-fits-nobody" air quality standard for the whole country, it would seem reasonable to allow communities to decide for themselves what level of air quality is sufficient, just as states and communities determine local levels of funding for education, crime prevention, and the like. Under such an approach, the EPA would still provide information on pollution levels, scientific assessments of potential public health concerns, and policy recommendations, but states and local regions would have the flexibility to evaluate the appropriateness of EPA judgments for their own areas. In those cases where pollution problems extend across state boundaries--such as the New York or Philadelphia metropolitan areas--creating a regional pollution control authority would likely be preferable to calling in the federal government.

That type of regulatory federalism would promote more rational priority setting and encourage innovative approaches to dealing with complex and costly problems. The current reliance on federal standard setting and technological fixes does neither.[151] Decisionmaking on environmental policy is currently too far removed from those whom the policies affect, and therefore there is little accountability.[152] The result is a clean air policy that has significantly more costs than benefits.[153] Local regions are required to adopt politically preferred but economically bankrupting control strategies to meet standards that few communities would voluntarily accept. An alternative approach would encourage the development of the most effective strategies of environmental protection and a more rational selection of environmental priorities based on their relative importance when weighed against other concerns.

Notes

[1] Two groups, the Sierra Club and the American Lung Association, have already announced their intent to sue the EPA to impose sanctions on the state of Virginia. See D'Vera Cohn, "Sierra Club, Health Group Sue EPA over Virginia Emissions Program," Washington Post, September 14, 1994.

[2] See "Pennsylvania: Legislature Overturns Governor's Veto, Delaying Auto Emission Inspection Program," BNA

National Environment Daily, November 17, 1994; and Margaret Kriz, "Clean Air Act's a Target," National Journal, January 14, 1995, p. 116. On Virginia's suit, see Amy B. Resnick, "State Sues EPA," Arlington Journal, January 10, 1995, p. A1.

[3] The OTR includes Maine, Maryland, Delaware, Pennsylvania, New Jersey, New York, Connecticut, Rhode Island, Massachusetts, New Hampshire, Vermont, the District of Columbia, and northern Virginia.

[4] OTC, "OTC Proposed Low Emission Vehicle Program for Public Comment," November 17, 1993.

[5] Gary Lee, "EPA Approves Plan for New Class of Low- Polluting Cars in Northeast," Washington Post, December 20, 1994, p. A4.

[6] "Air Pollution: OTC Low Emission Vehicle Plan Approved, But EPA Urges States to Adopt Alternative," BNA National Environment Daily, January 24, 1995.

[7] K. H. Jones, "The Truth about Ozone and Urban Smog," Cato Institute Policy Analysis no. 168, February 19, 1992.

[8] Internal EPA memorandum, cited in Jerry Taylor, "Update to the Truth about Ozone and Urban Smog," memorandum, Cato Institute, July 15, 1992, p. 7.

[9] OTC, "Response to Public Comments on the Ozone Transport Commission's Recommendation of a Regional Low Emission Vehicle Program," February 1994, p. 23.

[10] Cited in Taylor, p. 7.

[11] Cited in ibid., p. 8.

[12] The basic automobile inspection and maintenance program is, at present, required only in areas with populations of 50,000 or more. The EPA is proposing to raise that thresh- old to 200,000. 60 Federal Register (April 28, 1995): 20936.

[13] The waiver threshold is the maximum a car owner can be forced to spend repairing a vehicle in order to meet the emission requirements. Once the threshold amount is reached, the car owner is required to make no further repairs, even if the vehicle fails to meet the emission requirements.

[14] Jones, "The Truth about Ozone and Urban Smog," pp. 5-10.

[15] That estimate is based on New York Department of Environmental Conservation, "New York State Air Quality Implementation Plan, Ozone," November 1993; and Systems Applications International, "The Federal Low Emissions Vehicle Program: VOC and NOx Emissions Benefits in the Northeast," SAI, San Rafael, Calif., February 1994.

[16] As much as 70 to 80 percent of the emissions for a vehicle trip can occur during the cold start (personal communication with mobile source emission control staff of General Motors). See also J. G. Calvert et al., "Achieving Acceptable Air Quality: Some Reflections on Controlling Vehicle Emissions," Science, July 2, 1993, pp. 37-45.

[17] See S. T. Rao et al., "Statistical Analysis of Trends in Urban Ozone Air Quality," Journal of the Air & Waste Management Association 42 (1992): 1204; S. T. Rao and I. G. Zurbenko, "Detecting and Tracking Changes in Ozone Air Quality," Journal of the Air & Waste Management Association 44 (1994): 1089; and S. T. Rao et al., "Determining Temporal and Spatial Variations in Ozone Air Quality," Journal of the Air & Waste Management Association 45 (1995): 57.

[18] The states that voted against the recommendation were Delaware, New Hampshire, New Jersey, and Virginia.

[19] 59 Federal Register (April 26, 1994): 21724. In addition, the EPA has stated that "in light of the legislative history and statutory structure, it appears appropriate for EPA to at least resolve uncertainties in favor of approval, in deference to the OTC's determination of necessity. In other words, it appears appropriate for EPA to start with the

position that it should approve the OTC's recommendation unless it has sufficient factual basis to find that the LEV program is not necessary." 59 Federal Register (April 26, 1994): 21727.

[20] Matthew L. Wald, "California Car Rules Set as Model for the East," New York Times, December 20, 1994.

[21] 59 Federal Register (April 26, 1994): 21738.

[22] Ibid.

[23] The OTC position is that states should not be required to impose the ZEV sales mandate unless the EPA determines that the mandate is a necessary component of the California LEV program. That could be the case because the CAAA expressly forbid states other than California to develop their own vehicle emission standards. States can either accept federal standards as adequate or adopt California's standards; they cannot require the manufacture of a "third car."

[24] CARB's expectations are printed in Thomas C. Austin and James M. Lyons, "Cost Effectiveness of the California Low Emission Vehicle Standards," Society of Automotive Engineers Technical Paper no. 940471, 1993, Table 1.

[25] "OTC Recommends Clean Cars for Cleaner Air to EPA," OTC news release, February 1, 1994; and OTC, "Response to Public Comments," p. 59.

[26] Ibid., p. 48.

[27] Ibid., p. 59.

[28] The cost estimates of CARB, the American Automobile Manufacturers Association, and Sierra Research are all presented in Thomas C. Austin et al., "The Cost-Effective ness of Further Regulating Mobile Source Emissions," Sierra Research, Inc., Report no. SR94-02-03, February 1994, Table 5-3.

[29] OTC, "Response to Public Comments," p. 60. Emphasis in original.

[30] EPA, "Inspection/Maintenance Program Requirements: Final Rule," 57 Federal Register (November 5, 1992): 52950.

[31] CARB, "Proposed Regulations for Low-Emission Vehicles and Clean Fuels: Technical Support Document," August 13, 1990, p. IX-18.

[32] Austin et al., pp. 102, 107.

[33] See Rob Klausmeier, "Analysis of the Ozone Transport Commission's Draft Technical Support Document on the Pro- posed Low Emission Vehicle Program," Radian Corporation, December 9, 1993.

[34] Austin et al., Table 5-3.

[35] Quoted in James C. McKinley Jr., "EPA Seeks Emissions Agreement for Northeast," New York Times, August 24, 1994, p. B5.

[36] Austin et al., pp. 97-99.

[37] Ibid., p. 101.

[38] See Timothy P. Henderson and Michael Rusin, "Electric Vehicles: Their Technical and Economic Status," Research Study no. 073, American Petroleum Institute, Washington, January 1994, pp. 1-3; and Jim Motavalli, "California Dream ing," E magazine, July-August, 1994.

[39] "Electrosource, Inc., maintains its battery pack will sell for less than $10,000. That is much less than the $45,000

that Ford says is the cost of the sodium-sulfur battery pack used in its prototype electric cars." Oscar Suris, "Continental Divide: Californians Collide with Folks in Detroit over the Electric Car," Wall Street Journal, January 24, 1994, p. A5.

[40] The fast charging systems that have been devised thus far require far more current than is provided by normal household lines. Thus, a special charging unit that draws greater current is required. Such units could be installed in home garages but are likely to be very expensive.

[41] Oscar Suris, "Cold Weather Is Still a Problem in Electric Cars," Wall Street Journal, March 8, 1994, p. B1.

[42] See, for example, Motavalli, p. 30; and Suris, "Cold Weather," p. B1.

[43] Ibid., p. B10.

[44] Ibid.

[45] For various recent conversion and new electric car prices, see Henderson and Rusin, Appendix II, "Electric, Hybrid and Converted Vehicle Characteristics."

[46] Austin et al., p. 101.

[47] Daniel J. Dudek and Joseph Goffman, "Flexibility for Responsibility: Focusing on Reductions Rather Than Technology in Vehicle Emissions Control," Environmental Defense Fund, June 1994, p. 21.

[48] Ibid., p. 8.

[49] Sheldon R. Shacket, The Complete Book of Electric Vehicles, cited in Henderson and Rusin, p. 1.

[50] EPA, "Preliminary Electric Vehicle Emissions Assessment," November 3, 1993.

[51] Calvert et al., Table 1.

[52] However, it must be noted that many new cars in 1991 were already surpassing the CAAA-imposed 1994 emission standard; thus, it is difficult to attribute much additional new vehicle emission reduction to the CAAA. EPA, "Federal Certification Test Results for 1991 Model Year," April 1991.

[53] Calvert et al., Tables 1 and 2.

[54] 59 Federal Register (April 26, 1994): 21728.

[55] "Air Pollution." Emphasis added.

[56] "If the new technologies are more expensive than the old and/or have characteristics that make the vehicles less attractive to consumers, the rate of vehicle turnover will slow (called new source bias), offsetting some of the emissions reductions obtained by the low emitting vehicles that are purchased." Alan J. Krupnick, "Vehicle Emissions, Urban Smog, and Clean Air Policy," Discussion Paper QE92-09, Resources for the Future, February 1992, p. 23.

[57] Joseph White, "Even Detroit Concedes Sticker Shock," Wall Street Journal, August 8, 1991.

[58] Krupnick, p. 9.

[59] Klausmeier, Table 2-1.

[60] Ibid., p. 7.

[61] Calvert et al., p. 37.

[62] 57 Federal Register (November 5, 1992): 52950.

[63] Ibid.

[64] See, for example, Calvert et al., p. 40; Douglas Lawson, "'Passing the Test'--Human Behavior and California's Smog Check Program," Journal of the Air & Waste Management Association, December 1993, p. 1573; and Donald Stedman, Gary Bishop, et al., "On-Road Remote Sensing of CO and HC Emissions in California," Final Report, contract no. A032- 093, CARB, February 1994, p. 13.

[65] Calvert et al., p. 41.

[66] Stedman et al., p. 77.

[67] Calvert et al., p. 40.

[68] Lawson, "'Passing the Test,'" p. 1570. "When the data are analyzed in terms of their contribution to total emissions, it is apparent that there are too few old vehicles to be major contributors to mobile source emissions. Instead, the large number of newer vehicles that are not working properly are the greatest contributor to emissions." Stedman et al., p. 13.

[69] Ibid., p. 30.

[70] Ibid., p. 13.

[71] Two possible exceptions are the proposed use of on-road testing of vehicle emissions, such as the remote sensing system developed at the University of Denver, and the use of emissions-based registration fees (though those may require an on-road test for enforcement).

[72] Lawson, "'Passing the Test,'" Table V.

[73] Unless otherwise noted, descriptions of the AAMA proposal are from AAMA press release, December 6, 1993; and AAMA, "Improving Air Quality in the Northeast and Mid-Atlantic States: A Backgrounder on the Industry's Federal Low Emission Vehicle Proposal," July 1994.

[74] "Air Pollution."

[75] AAMA, "Fact Sheet: Federal Low Emission Vehicle Proposal," July 1994.

[76] AAMA president Andrew Card, quoted in AAMA press release, December 6, 1993.

[77] Hugh Ellis, "An Analysis of Ozone Control Strategies for Maryland: Final Report," Johns Hopkins University, Baltimore, January 17, 1994, p. iv.

[78] OTC, "Response to Public Comments," Appendix, p. 2.

[79] Ibid., pp. 45, 48. Those considerations are not part of the OTC's mandate, and there is substantial research that suggests that such issues should not be the concern of the federal government at all.

[80] 59 Federal Register (April 26, 1994): 21727.

[81] 57 Federal Register (November 5, 1992): 52950.

[82] Current idle test equipment ranges from $15,000 to $40,000 per lane; IM240 test equipment costs approximately $140,000 per lane. Ibid. It should also be noted that more IM240 lanes are required than idle test lanes to test the same number of cars in the same amount of time. That means that either more lanes are purchased, more costs are imposed

on drivers due to longer waiting times, or tests are done less frequently and the emissions reductions are reduced.

[83] Ibid.

[84] Cited in Lawson, "'Passing the Test,'" p. 1567. There is something incongruous about the EPA's relying on the OTC's cost estimates for its LEV proposal when the OTC and the EPA have explicitly identified different policies as the most cost-effective approach to air pollution control.

[85] Douglas Lawson, "The Costs of 'M' in I/M--Reflections on Inspection/Maintenance Programs," prepublication draft, November 23, 1994, p. 10.

[86] Ibid.

[87] General Accounting Office, "Unresolved Issues May Hamper Success of EPA's Proposed Emissions Program," GAO/RC ED-92-288, September 1992, pp. 1-2.

[88] 57 Federal Register (November 5, 1992): 52950.

[89] Lowell Ashbough et al., "Emission Characteristics of California's 1989 Random Roadside Survey," California Air Resources Board/NAMVECC, December 1990, pp. 4-5.

[90] Lawson, "'Passing the Test,'" p. 1570.

[91] Stedman et al., p. 58.

[92] Lawson, "The Costs of 'M,'" p. 11.

[93] The EPA maintains that "neither the [1990 Clean Air] Act's language nor EPA's performance standard requires states to implement annual, centralized testing. States have flexibility to design their own programs if they can show that their program is as effective as the 'model' program used in the performance standard." 57 Federal Register (November 5, 1992): 52950. However, in practice the EPA has been unwilling to accept arguments that decentralized programs can be equally effective.

[94] See, for example, Resnick; and "Beginning in 1995: Reformulated Gas, Enhanced I/M Programs," BNA State Environment Daily, January 9, 1995.

[95] 57 Federal Register (November 5, 1992): 52950.

[96] David Driesen, "Alternative Roads to Cleaner Air" (letter), Washington Post, January 1, 1995, p. C6.

[97] Jerry Aroesty et al., "Restructuring Smog Check: A Policy Synthesis," DRU-885-CSTC, RAND Corporation, Santa Monica, Calif., October 1994, p. ix.

[98] Ibid., p. 69; and Lawson, "'Passing the Test.'"

[99] Ibid., p. 1573.

[100] Ibid., p. 1574.

[101] Winston Harrington, Margaret A. Walls, and Virginia McConnell, "Shifting Gears: New Directions for Cars and Clean Air," Discussion Paper 94-26, Resources for the Future, Washington, June 1994, p. 20. Emphasis in original.

[102] That approach is discussed in Stedman et al. and Jonathan H. Adler, "Reforming Arizona's Air Pollution Policy," Arizona Issue Analysis Report no. 127, Goldwater Institute, Phoenix, Ariz., January 1993.

[103] 60 Federal Register (April 28, 1995) 20934.

[104] EPA, "Employee Commute Options Guidance," ANR-443, December 1992, p. 4.

[105] Ibid.

[106] In New York, for example, the fees will range from $300 to $2,000 per worksite. Donald W. Stever Jr. and Eliza A. Dolin, "Car Pool or Consequences: State Issues Final Rules in Commuter Program," New York Law Journal, June 13, 1994, p. S1.

[107] Pamela S. Reiman and Stephen C. Yohay, "Compliance with the Clean Air Act Employer Trip Reduction Requirements," Employee Relations Law Journal, March 22, 1994, p. 21.

[108] GAO, "Reducing Vehicle Emissions with Transportation Control Measures," GAO/RCED-93-169, August 1993, pp. 4, 6.

[109] "Commuting accounts for a declining share of vehicle travel, from about one-third in 1969 to a quarter in 1990." David Andrew Price, "Newest Mandate--Everyone into the Carpool," Wall Street Journal, November 8, 1993.

[110] Caryn A. McBride, "The Federal Clean Air Act: Rx for Environment--Or Plague on Area Economy," Fairfax County Business Journal, November 15, 1993.

[111] Cited by Robert Poole, Auto Emissions and Congestion Charging: Addressing California's Infrastructure and Air Pollution Crises (Los Angeles: Reason Foundation and Competitive Enterprise Institute, April 1990).

[112] The percentage of emissions attributable to the cold start will vary depending on the length of the trip and the driving conditions. However, for most cleaner vehicles, the cold start emissions will be as much as or greater than emissions while the vehicle is on the road.

[113] "Resistance to CAA Car Pool Mandates Draws Congressional Attention," EPA Watch, July 15, 1994, p. 1.

[114] Caleb Solomon, "Head-On Collision: Cut Auto Commuting? Firms and Employees Gag at Clean-Air Plan," Wall Street Journal, September 8, 1994, p. A6.

[115] Robert Reinhold, "Hard Times Dilute Enthusiasm for Clean-Air Laws," New York Times, November 26, 1993, p. A30.

[116] GAO, p. 8.

[117] Ibid.

[118] Catherine Romano, "Business Copes with the Clean Air Conundrum; Employee Trip Reduction Provision of the 1990 Clean Air Act," Management Review, February 1994; and "Why Do Commuters Drive Alone?" Urban Mobility Corporation Innovation Briefs 5, no. 3 (February 1994).

[119] Ibid.

[120] "Proposed Rule to Implement an Employee Commute Option Program for the New York Metropolitan Region," State of New York Department of Transportation, November 24, 1993, p. 9.

[121] Estimates cited in Wade Lambert, "Businesses Must Wean Workers from Their Cars," Wall Street Journal, November 4, 1993. EPA estimates of approximately $100 per employee per year are based on figures provided in EPA, "Employee Commute Options Guidance," p. 20.

[122] See, for example, "Clean Air Act Approval and Promulgation of Title I, Section 182(d)(1)(B), Employee Commute Options/Employer Trip Reduction Program for Texas," 58 Federal Register (October 18, 1993): 53694.

[123] EPA, "Employee Commute Options Guidance," pp. 14, 20.

[124] See "State Flexibility in Meeting Goals of Air Act Pledged by EPA Official," BNA State Environment Daily, July 29, 1994; and "Resistance to CAA Car Pool Mandates," p. 2.

[125] Reiman and Yohay, p. 21.

[126] The offset requirements for new development in non- attainment areas under the CAAA of 1990 also have that impact, as do the retroactive liability provisions of the Comprehensive Environmental Response, Compensation and Liability Act (Superfund).

[127] Barbara Presley Noble, "Getting Them There Is Half the Job," New York Times, November 21, 1993; and Reiman and Yohay.

[128] See, for example, E. S. Savas, Sigurd Grava, and Roy Sparrow, "The Private Sector in Public Transportation in New York City: A Policy Perspective," Institute for Transportation Systems, CUNY, January 1991.

[129] E. S. Savas, "Getting around New York," City Journal 3, no. 3 (Summer 1993): p. 64.

[130] That issue is also discussed in the context of southern California in Michael Cameron, "Transportation Efficiency: Tackling Southern California's Air Pollution and Conges- tion," Environmental Defense Fund and Regional Institute of Southern California, Oakland, March 1991.

[131] See, for example, Donald C. Shoup and Richard W. Wilson, "Commuting, Congestion, and Pollution: The Employer- Paid Parking Connection," Policy Insight no. 147, Reason Foundation, Los Angeles, September 1992.

[132] Quoted in McBride, p. 108.

[133] On the Clinton administration's proposal, see David E. Rosenbaum, "Clinton Has a Plan That Would Pay Some People for Not Driving to Work," New York Times, January 27, 1994.

[134] OTC, "Response to Public Comments," p. 23.

[135] See Jones, "The Truth about Ozone and Urban Smog"; and Taylor.

[136] It should be noted that the EPA considers "cost-effectiveness as a criterion, but not the only criterion, in evaluating the reasonableness of controls." 59 Federal Register (April 26, 1994): 21727. In particular, the EPA has pointed to the "socio-economic distribution of the burden of particular measures, employment impacts" and other considerations as acceptable criterion. Ibid. That would seem to allow the EPA to use the extent to which a control strategy embodies the "polluter pays" principle as a criterion for evaluation.

[137] One possible combination of cost-effective and more equitable emission control strategies is outlined in "Clean Air Attainment in Maricopa County: An Alternative Scenario," Goldwater Institute for Public Policy Research, Phoenix, Ariz., and Competitive Enterprise Institute, Washington, October 20, 1993.

[138] 59 Federal Register (April 26, 1994): 21721.

[139] Public Law 101-549 (November 15, 1990) 104 Stat. 2429.

[140] OTC, "Response to Public Comments," p. 52. That is a real concern because the EPA is notoriously late in its review and promulgation of regulations and state implementation plans.

[141] American Lung Association, "Breath in Danger II," Washington, March 1993.

[142] K. H. Jones, "1993 Ozone Air Quality Update, Associated Population Exposure and Trends Analysis," prepared for American Automobile Manufacturers Association, October 1993.

[143] See 44 Federal Register (February 8, 1979): 8220; and Kenneth Chilton and Ann Sholtz, Battling Smog: A Plan for Action, Formal Publication no. 93 (St. Louis: Center for the Study of American Business, Washington University, September 1989), pp. 7-14.

[144] See Jones, "The Truth about Ozone and Urban Smog," for a fuller discussion of this issue, as well as K. H. Jones, "The 1990/91/92 Ozone Data Base and Its Implications Relative to Currently Designated Ozone Non-Attainment Area Regulatory Programs," Proceedings of the Air and Waste Management Association Technical Conference on Tropospheric Ozone, Boston, Mass., October 1992; and K. H. Jones, "The 1991/92/93 Ozone Data Base and Its Implications in Regard to the Attainment Projections for the Northeast Ozone transport Region," Presented at the Air and Waste Management Association Technical Conference on Tropospheric Ozone, Orlando, Fla., May 1994.

[145] James Lis and Kenneth Chilton, "Using the Wrong Measures for Smog," Regulation, no. 1 (1994): 56-58.

[146] Dudek and Goffman, pp. 3, 7.

[147] Rick Henderson (letter response), Policy Review, no. 61 (Summer 1992): 93.

[148] This is discussed in National Research Council, Committee on Tropospheric Ozone Formation and Measurement, Rethinking the Ozone Problem in Urban and Regional Air Pollution (Washington: National Academy of Sciences Press, 1991).

[149] See, for example, EPA Science Advisory Board, Reducing Risk: Setting Priorities and Strategies for Environmental Protection (Washington: EPA, 1990); EPA, Unfinished Business: A Comparative Assessment of Environmental Problems (Washington: EPA, February 1987); and, more generally, Stephen Breyer, Breaking the Vicious Circle: Toward Effective Risk Regulation (Cambridge, Mass.: Harvard University Press, 1993).

[150] See, for example, R. Shep Melnick, "Pollution Deadlines and the Coalition for Failure," in Environmental Politics: Public Costs, Private Rewards, ed. M. S. Greve and F. L. Smith (New York: Praeger, 1992).

[151] When particular technologies must be adopted by particular dates, "manufacturers may be compelled to select those technologies that are most readily available without regard to whether or not even more promising or preferable technologies may be developed if given more time." Dudek and Goffman, p. 8.

[152] This is the general critique of the problem of unfunded regulatory mandates.

[153] See, for example, Alan Krupnick and Paul Portney, "Controlling Urban Air Pollution: A Benefit-Cost Assessment," Science, April 1991, pp. 522-28.