Assessing California vs. Federal Automobile Emissions Standards for Pennsylvania

Testimony to the Pennsylvania House of Representatives

Committee on Environmental Resources and Energy

February 8, 2006

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In terms of future air pollution levels, Pennsylvania's policy debate over whether to rely on federal Tier 2 or California LEV II automobile emissions standards is much ado about very little. Both standards will eliminate the vast majority of remaining automobile air pollution. But the stakes are high in terms of costs. The LEV II standards will be far more costly, mainly due to LEV II's stringent fuel economy mandate. Pennsylvania can meet its clean air goals at the least cost by avoiding LEV II and instead relying on federal Tier 2 standards. To the extent Pennsylvania needs additional automobile pollution reductions, these would be best achieved not by trying to make extremely clean new cars just a tiny bit cleaner, but by implementing a program to identify and repair or scrap the few percent of cars on the road that account for most automobile emissions.

1. **Both federal Tier 2 and CA-LEV II will eliminate the vast majority of remaining automobile air pollution.** In terms of air pollution, this isn't a debate about whether the air will get much cleaner—both federal and California requirements will eliminate the vast majority of remaining automobile air pollution. Instead, Pennsylvania faces the following choice: During the next two decades, will Pennsylvania eliminate about 80 percent of all automobile pollution (federal Tier 2) or about 82 percent of all automobile pollution (CA-LEV II).

    a. **Tier 2 and LEV II provide virtually the same air pollution benefits.** Figure 1 displays the trend in future oxides of nitrogen (NOx) and volatile organic compound (VOC) emissions of the Pennsylvania automobile fleet, as predicted by the EPA's MOBILE6 vehicle emissions model.[1] The model predicts that under Tier 2, between 2005 and 2025, VOC+NOx emissions of the average vehicle will decline just over 74%. As the chart shows, the CA-LEV II requirements add only tiny incremental improvement to the large benefits of Tier 2. The estimates in Figure 1 are the emissions of the average automobile. But total driving will also increase over the next 20 years, offsetting some of the benefits of cleaner cars. Total driving has been increasing by about 1.5% per year in Pennsylvania during the last decade. If this trend continues, then total driving would increase 35% between 2005 and 2025. In that case, MOBILE6 predicts that by 2025 total automobile emissions would decline 65% under Tier 2 and 68% under LEV II.[2]

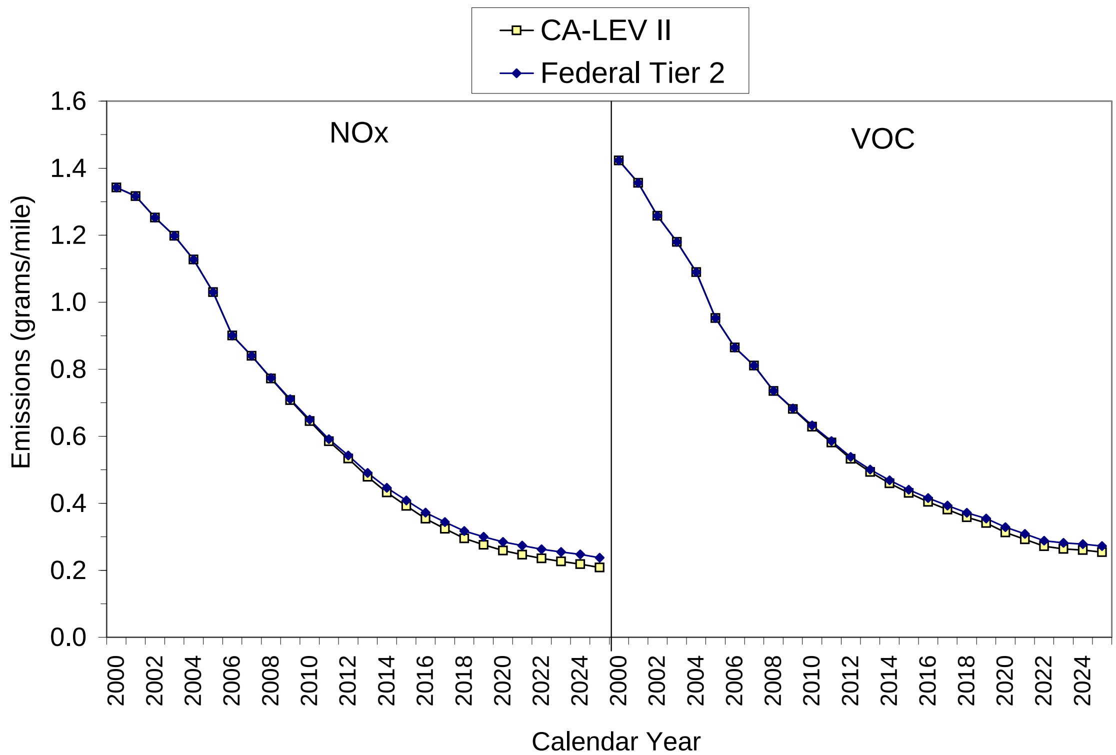
    It is important to note that MOBILE6, like previous versions of the MOBILE model, underestimates the likely improvement in future automobile emissions. How do we know this?: First, a recent comparison of MOBILE6's predictions with on-road remote sensing measurements showed that MOBILE6 overestimated the emissions of

[1] Pennsylvania-specific MOBILE6 estimates were provided by Air Improvement Resource. The CA-LEV II estimate includes the benefits of the Zero Emissions Vehicle (ZEV) mandate.

[2] See this as follows: Assume total emissions equal 1.0 in 2005. If total driving stayed the same, but emissions of the average vehicle declined 75%, then total emissions would drop to 0.25. But if driving also increased by 35%, then total emissions would be 0.25 * 1.35 = 0.34, or a 66% reduction from the original emissions level of 1.0.

newer cars relative to older cars.[3] This means that MOBILE6 will underestimate future improvements in fleet-average emissions, because the model gives too little credit for the benefits of retiring older cars, and doesn't give enough credit for NLEV and Tier 2 cars.

Figure 1. Comparison of future VOC and NOx emissions under federal Tier 2 and California LEV II, as predicted by EPA's MOBILE6 emissions model.



Second, MOBILE6 assumes a slower improvement in VOC emissions during the last decade than was actually observed in on-road emissions measurements and vehicle inspection program data.[4]

Third, MOBILE6 assumes that average NOx emissions will decline in the future at about the same percentage rate as they have during the last decade. This is implausible, because of the huge percentage reduction in NOx emissions under Tier

[3] P. McClintock, "Mobile6 vs. On-Road Exhaust Emissions and Mobile6 Evaporative Credits vs. I/M Gas Cap Failures," 19th Annual Mobile Sources Clean Air Conference, Steamboat Springs, Colorado, 2003.

[4] MOBILE6 assumes an improvement of about 8% percent year, while the on-road and inspection data suggest about a 12% improvement each year. For details on real-world automobile emissions improvements, see S. S. Pokharel, G. A. Bishop, D. H. Stedman et al., "Emissions Reductions as a Result of Automobile Improvement," *Environmental Science and Technology* 37 (2003): 5097-101; J. Schwartz, *No Way Back: Why Air Pollution Will Continue to Decline* (Washington, DC: American Enterprise Institute, July 2003), http://www.aei.org/docLib/20030804_4.pdf.

2. For example, under Tier 1, which was in effect for the 1994-2000 model years, cars and medium SUVs had to meet a standard of 0.4 grams/mile and larger SUVs had to be under 0.7 grams/mile. Pre-Tier 1 standards allowed emissions topping 1 gram/mile. But Tier 2 lowered allowable emissions down to 0.05 grams/mile for all automobiles. Tier 2 also has longer durability requirements and applies to larger vehicles than previous standards.

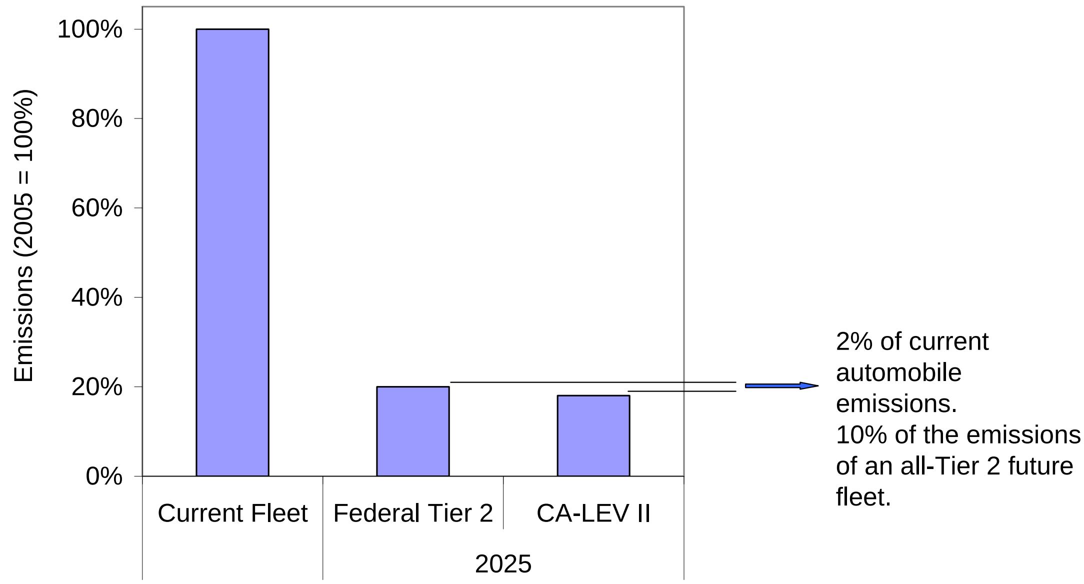
Fourth, a comparison of MOBILE6's estimates with the actual Tier 2 requirements also suggests that the model understates future improvements. According to the model, fleet-average VOC+NOx emissions are currently around 2 grams/mile in Pennsylvania, but will decline only to about 0.5 grams/mile by 2025, when virtually the entire fleet would be Tier 2 automobiles. But based on the actual requirements of the Tier 2 standards, an all Tier 2 fleet of the same age distribution as the current fleet would likely emit far less than this.

Taking all of these factors into account, an all-Tier 2 fleet will likely be about 90% cleaner than the average automobile on the road in 2005. If so, then combining this with a 35% increase in driving, total automobile emissions would decline about 86% from 2005 to 2025. To err on the side of caution, I assume in the rest of these comments that total automobile emissions will decline about 80% under Tier 2. Given the roughly 10% incremental improvement predicted for CA-LEV II over and above Tier 2, total emissions would decline 82% under CA-LEV II.

b. **PA-DEP's claim of large benefits from CA-LEV II is misleading.** Pennsylvania's Department of Environmental Protection (DEP) has been claming that CA-LEV II will reduce automobile NOx by 9% and VOC by 6%-12%.[5] This claim is based on using *future emissions of a Tier 2 fleet* as a baseline, rather than *current* fleet emissions. But that future Tier 2 fleet already has emissions that are about 80% lower than current emissions. When you start from a smaller baseline, any given absolute change gives a larger percentage change. Compared with *current* emissions of the automobile fleet, DEP's CA-LEV II benefit claim becomes 1.2%-2.4%. Figure 2 shows how you can get two different percentages from the same absolute change in total emissions. The figure also shows that the incremental benefits of LEV II relative to Tier 2 are tiny. Without the context of current emissions, DEP made the benefits of LEV II seem much larger than they really are.

[5] See, for example, January 31, 2006 letter from Secretary McGinty to Senator White.

Figure 2. Emissions of future Tier 2 and LEV II fleets, relative to current fleet



Notes: Emissions are indexed to 100% in 2005 and estimated to drop 80% by 2025 under Tier 2. PA-DEP estimates about a 10% additional improvement when compared to Tier 2, but this is only a 2% improvement relative to current emissions.

Secretary McGinty claims that by 2025 CA-LEV II will reduce VOC by an additional 2,850-6,170 tons/year and NOx by an additional 3,540 tons/year. Thousands of tons sounds like a lot, but only because the Secretary did not provide the appropriate context by comparing these incremental LEV II benefits to current baseline emissions. The DEP estimates total VOC+NOx emissions in Pennsylvania to be about 1 million tons/year, with about one-third coming from automobiles. Thus, even by the Secretary's own accounting, the incremental benefits of CA-LEV II amount to about a 2% reduction relative to current automobile emissions.

Through lack of context and misleading baselines, the DEP has greatly exaggerated the air pollution benefits of CA-LEV II relative to Tier 2. Using current emissions as a baseline, both Tier 2 and LEV II will eliminate the vast majority of remaining air pollution, and the difference between Tier 2 and LEV II would be too small to measure.

c. **Requiring CA-LEV II will actually *worsen* air quality when compared with federal Tier 2 by slowing fleet turnover.** The emissions estimates discussed above assume that fleet turnover would be the same under Tier 2 or LEV II. However, in reality, the higher costs of CA-LEV II automobiles will slow fleet turnover, reducing the rate at which older higher-polluting automobiles are replaced (see below for more details on the increased costs of CA-LEV II). Whatever the *ultimate* benefits of LEV II relative to Tier 2, emissions during the next 10 or 15 years will likely be higher under LEV II than under Tier 2, because slower fleet turnover will more than offset the tiny emissions benefits of CA-LEV II relative to Tier 2.

d. **Real-world data show that automobile emissions are declining rapidly, and will continue to decline.** How do we know that both Tier 2 and LEV II will eliminate most remaining automobile pollution?

(1) Data collected on the road and in vehicle inspection programs from about 1994 to 2004 in several cities around the U.S. show that the emissions of the average automobile (including cars, SUVs, and pickup trucks) have been dropping about 10% per year.[6] Total driving has been increasing less than 2% per year, resulting in large net declines in total automobile emissions nationwide.

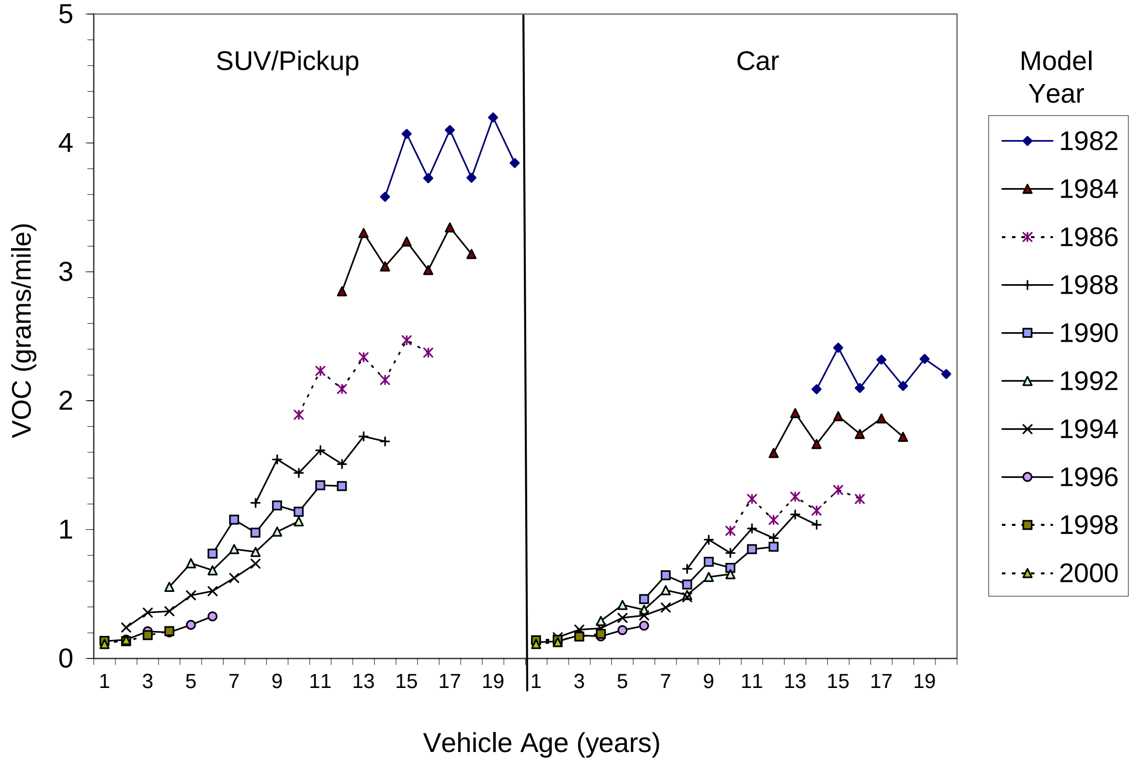
(2) When these data are disaggregated by model year, they show that with each successive model-year, the average automobile is starting out and staying cleaner than automobiles built in previous years. That is, when compared at the same age, automobiles built more recently have lower emissions than automobiles built in previous years.

This is shown in Figure 3 with data from Denver's vehicle emissions inspection program, collected during calendar years 1996-2002. The graph shows average VOC emissions versus age for even model years starting with the 1982 model year, through the 2000 model year. Cars and SUVs/pickup trucks are shown separately. Because each model year is measured at several ages, we can compare different model years at the same age. For example, between calendar years 1996-2002, the 1984 model year was measured at ages 12 through 18, while the 1986 model year was measured at ages 10 through 16. Thus, both the 1984 and 1986 model years were measured at ages 12 through 16. Looking at the graph, we can see that from ages 12-16, 1986 model-year SUVs were about 35% cleaner than 1984 model-year SUVs.

A similar conclusion applies for all model years and ages: more recent models start out and stay cleaner than earlier models. This shows that even if we had stopped with standards applicable to automobiles built in 2000, we would still eliminate most automobile emissions over the next 15 to 20 years. But the federal NLEV program came into effect with the 2001 model year and Tier 2 with the 2004 model year, pushing emissions down still further (as will be discussed in more detail in Figures 5 and 6, below).

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

Figure 3. Average automobile VOC emissions. Comparison of emissions versus age for model years 1982-2000.



Notes: Data from the Denver vehicle emissions inspection program collected during June-August in calendar years 1996-2002. Data provided by Tom Wenzel, Lawrence Berkeley National Laboratory. The zig-zag pattern results from the fact that even model-year cars are generally tested in odd calendar years only if they are sold. Cars that are sold tend to be in worse shape, and therefore tend to have higher emissions, than cars that are not sold. Thus, for any even model-year, the group of cars tested in odd calendar years will tend to have higher emissions than the group tested in even calendar years, creating the zig-zag pattern.

(3) Emissions of SUVs and pickup trucks have been improving faster than emissions of cars, and caught up with cars around the 2001 model year for NOx and the 1996 model year for VOC.[7] Figure 3 shows that earlier SUVs and pickup trucks had much substantially higher emissions than cars, but that they also improved more quickly than cars. Both Tier 2 and LEV II require the same low emissions from all classes of vehicles, so there will be no difference going forward.

(4) Ambient pollution measurements also show that levels of air pollutants directly emitted by automobiles have been declining rapidly. Figure 4 shows the trend in nitrogen dioxide (NO2) and carbon monoxide (CO) from 1995-2004 in Pennsylvania, as well as the trend in total vehicle-miles of driving. The air pollution trends are based on all sites that operated continuously in the state during the period in question.

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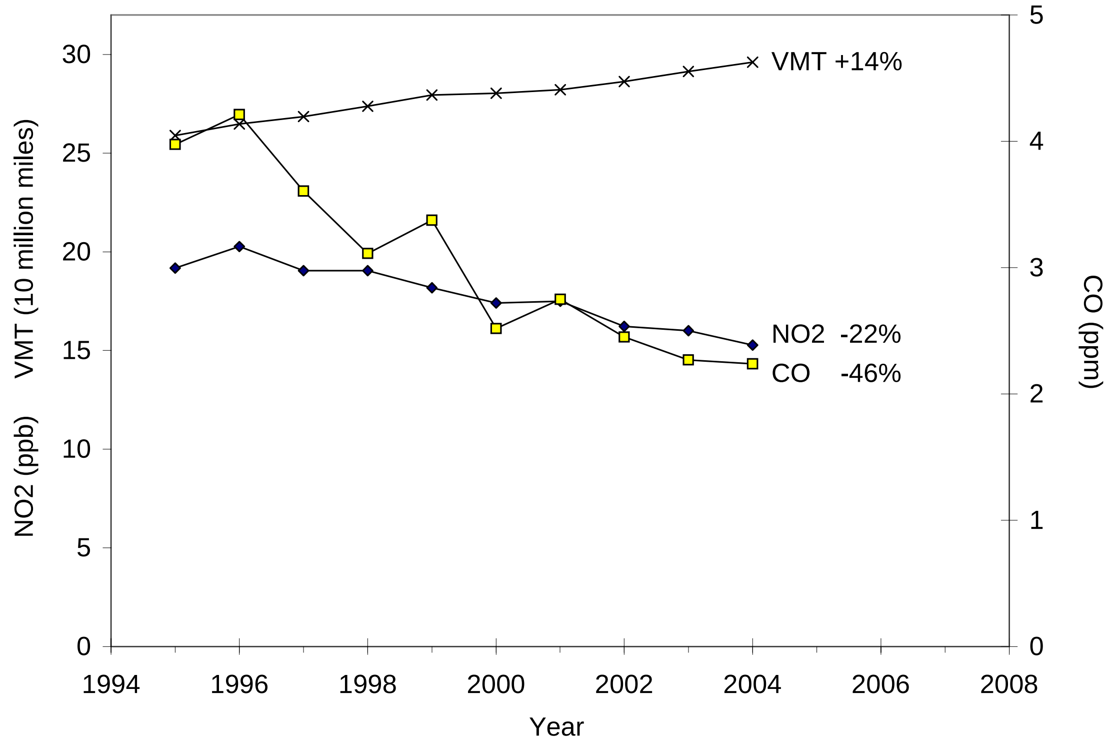
[7] Ibid.

Note that from 1995-2004, CO decreased 46%, and NO2 decreased 22%, even though total miles of driving rose 14%. A recent study of air toxics in the Philadelphia metro concluded that despite a 57% increase in total miles of driving between 1990 and 2003, ambient levels of motor-vehicle related pollutants sharply declined as follows: benzene -65%; ethylbenzene -66%; acetaldehyde -72%; formaldehyde -60%.[8] Automobiles account for almost all CO emissions, most benzene emissions, and about one-third of NO2 emissions, so these trends are the result of large reductions in pollution emitted from automobiles.

Figure 4. Trends in ambient levels of nitrogen dioxide (NO2), carbon monoxide (CO), and daily vehicle miles of travel (VMT) in Pennsylvania; 1995-2004.



Notes: VMT = daily vehicle miles traveled in units of 10 million miles; NO2 = nitrogen dioxide in parts per billion (ppb); CO = carbon monoxide in parts per million (ppm). CO trend is based on 16 locations with continuous data from 1995-2004. NO2 trend is based on 22 locations with continuous data from 1995-2004. The CO trend is based on the maximum reading each year at each monitoring location. The NO2 trend is based on the annual average. NO2 and CO data were downloaded from EPA at http://www.epa.gov/air/data/geosel.html. VMT estimates were downloaded from federal Department of Transportation at http://www.fhwa.dot.gov/policy/ohpi/hss/hsspubs.htm.

[8] Regi Oommen, Jaime Hauser, Dave Dayton, and Garry Brooks, 2005, "Evaluating HAP Trends: A Look at Emissions, Concentrations, and Regulation Analyses for Selected Metropolitan Statistical Areas," EPA 14th Annual Emission Inventory Conference, April 12-14, 2005, Las Vegas, http://www.epa.gov/ttn/chief/conference/ei14/poster/oommen.pdf.

(5) EPA's Tier 2 requirements began phasing in with the 2004 model year. Tier 2 eliminates most remaining VOC and NOx emissions in four ways: (1) more stringent tailpipe standards; (2) more stringent evaporative standards; (3) increased durability requirements, both in terms of length of warranty, and amount of emissions deterioration allowed; and (4) extending the light-duty emission requirements to very large SUVs, such as Suburbans and even Hummers, meaning that these large vehicles must meet the same tough standards as cars.

(6) EPA's mobile source emissions model predicts large declines in future emissions under Tier 2. According to the MOBILE6 model, under Tier 2, emissions of the average automobile would decline a bit more than 74% between 2005 and 2025.[9] With CA-LEV II, the decline would be nearly 77%. As noted earlier, this is a substantial underestimate of the likely benefits of both Tier 2 and LEV II, but it is nevertheless a large improvement when compared with current emissions.

It has become fashionable among regulators and environmentalists to claim that increases in driving are offsetting the benefits of cleaner cars, necessitating the implementation of tougher standards. These claims are never backed up with actual data, and in fact the data show just the opposite. Even if we had stopped with emissions standards applicable to the 2000 model year, total automobile emissions would still have continued to declined for many years to come. Tier 2 cars are so clean that future increases in driving will have hardly any offsetting effect on future emissions.

2. **CA-LEV II will be costly for Pennsylvanians.** While there is little difference between the emissions of Tier 2 and LEV II cars, there is a big difference in costs. The extra costs occur for two reasons: First, LEV II automobiles are required to have slightly lower pollution emissions, on average, than Tier 2 automobiles.[10] Second, unlike Tier 2, LEV II includes fuel economy requirements that will likely impose substantial net costs on motorists, probably in the range of a few thousand dollars per car, even after accounting for the savings from lower gasoline costs.

   Regulators and environmentalists claim that there is no extra cost for the lower emissions of LEV II automobiles, and that the LEV II fuel economy requirements will result in net savings to motorists. For example, PennFuture claims "Clean cars are not more expensive than cars that do not meet the strict [LEV II] pollution standards."[11] Secretary McGinty claims the CA-LEV II emissions requirements will "[cost] essentially nothing" and the fuel economy requirements will save motorists $3.50-$7.00 per month.[12]

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[9] Pennsylvania-specific MOBILE6 runs were provided by Air Improvement Resource.

[10] In order to distinguish between regulations related to air pollutants from automobiles (e.g., VOC, NOx, and CO) and regulations related to carbon dioxide from automobiles, I will refer to the air pollutant regulations as "emission" requirements, and the carbon dioxide regulations as "fuel economy" requirements.

[11] PennFuture, "Lemon Law," *PennFuture Facts*, January 25, 2006, http://www.pennfuture.org/index.cfm?myPageName=items/index&action=List&pagename=Item&backpage=Summary&nodate=1&category=facts&area=news&id=1802&archive=0.

[12] Kathleen McGinty, letter to Richard Geist, November 1, 2005.

a. **Reducing automobile pollution is not free.** According to DEP, LEV II automobiles emit, on average, 6%-12% fewer air pollutants than Tier 2 automobiles. DEP claims these pollution reductions are free. But if reducing pollution from automobiles were free, we would not be at this hearing, because there would be no policy debates over tightening automobile emissions standards. Automakers would be voluntarily meeting LEV II standards without any prodding from regulators, and they would be advertising that fact to entice prospective customers.

   Unfortunately, transparent estimates of the incremental cost of LEV II emissions requirements relative to Tier 2 are not available, largely because much of the information needed to assess real costs is proprietary. However, it might be as much as several hundred dollars per car for states that adopt the Zero Emissions Vehicle mandate as part of LEV II.[13]

b. **Fuel-economy mandates harm motorists.** That fuel-economy mandates could make motorists better off might seem superficially more plausible. After all, higher fuel economy means lower gasoline costs. But motorists already know what gasoline costs and they also know that gasoline prices can be volatile. Motorists who value fuel economy have for many years been able to choose from a wide array of car models that get more than 30 miles per gallon. Yet motorists on average choose cars that get about 21 miles per gallon. Likewise, automakers have powerful incentives to cater to consumers' tastes. The industry is fiercely competitive and manufacturers and dealers are desperate to figure what will make prospective buyers choose their cars, rather than competitors' cars.

   What would have to be true for government fuel-economy mandates to make consumers better off? There are two possibilities: (1) government regulators know more about what auto consumers want in a car than those auto consumers themselves. (2) government regulators know more than automakers about how to make cars with the most attractive (to consumers) combination of amenities, performance, and cost (including operating costs). There is roughly a zero chance that either of these propositions is true, and government fuel-economy mandates therefore can only make consumers worse off. That is exactly the conclusion drawn by most economists who have assessed this issue.[14]

   The LEV II fuel economy mandate requires nearly a 60% increase in the average fuel economy of cars and smaller SUVs and pickup trucks between 2009 and 2016, and a

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[13] Tom Austin, *Incremental Costs and Cost-Effectiveness of California Emissions Standards*, presentation to the National Research Council committee on state practices in setting mobile source emissions standards (Sacramento: Sierra Research, April 14, 2005).

[14] See, for example, Paul R. Portney, Ian W. H. Parry, Howard K. Gruenspecht, and Winston Harrington, "The Economics of Fuel Economy Standards," *Journal of Economic Perspectives* 17 (2003): 203-17; Andrew Kleit, "Impacts of Long-Range Increase in the Fuel Economy (CAFÉ) Standard," *Economic Inquiry* (April 2004): 279-94; Randall Lutter and Troy Kravitz, *Do Regulations Requiring Light Trucks to be more Fuel Efficient Make Sense? An Evaluation of NHTSA's Proposed Standards* (Washington, DC: AEI Brookings Joint Center for Regulatory Studies, February 2003); Congressional Budget Office, *The Economic Costs of Fuel Economy Standards versus a Gasoline Tax* (Washington, DC: 2003).

35% increase for larger SUVs and pickups.[15] The California Air Resources Board (CARB) estimated that when fully implemented, its fuel economy requirements would add about $1,000 to the cost of a new automobile, but would save motorists about $2,700 in gasoline costs, for a net savings of $1,700 over the life of the vehicle. If CARB's cost estimate were accurate, and if greater fuel economy could be delivered without sacrificing other attributes that motorists value in an automobile, then CARB's fuel economy mandate would indeed make motorists better off. But in fact CARB understated the likely net costs of increasing automobiles' fuel economy and ignored other attributes that would have to be sacrificed in the quest for greater fuel economy.

Here are a few of the errors and unrealistic assumptions CARB made in estimating the costs of improving fuel economy and the savings from lower gasoline consumption:[16]

- CARB used an unrealistically high new-car cost as a "no regulation" baseline for 2009 when the LEV II fuel economy standards begin to phase in. Assuming higher baseline costs makes the extra costs of the fuel economy requirements appear smaller.
- CARB assumed an average vehicle lifetime mileage of 202,000 miles for cars and 224,000 miles for SUVs and pickup trucks. But the true lifetime mileage of the average California automobile is about 155,000 miles.
- CARB used a discount rate of 5% for determining the current value consumers place on future savings in gasoline costs. In other words, CARB assumed that motorists would be willing to pay a dollar more today in the purchase price of a car in order to earn a return of $1.05 per year in fuel savings in the future. This is implausible, because auto loan rates have an interest rate of about 8%. CARB in effect assumed that consumers would be willing to borrow money at an 8% per year interest rate in order to earn a return of 5% per year on gasoline savings.
- CARB assumed a 40% markup in going from manufacturer costs to retail prices. But a more realistic markup in the automobile industry is 105%.
- Many new technologies would have to be added to car engines and transmissions and many components would have to be modified in order to achieve the fuel economy increases LEV II requires. CARB assumed that there would not be any costs incurred to integrate these changes into vehicle designs.
- CARB solicited cost estimates from vendors of fuel-economy technologies, and then arbitrarily reduced those costs by 30% for "unforeseen innovations in

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[15] CARB, *The California Low-Emission Vehicle Regulations* (Sacramento: 2005), http://www.arb.ca.gov/msprog/levprog/cleandoc/cleancompletelev-ghgregs11-7.pdf.

[16] These items are summarized from Sierra Research, *Review of the August 2004 Proposed CARB Regulations to Control Greenhouse Gas Emissions from Motor Vehicles: Cost Effectiveness for the Vehicle Owner or Operator*, prepared for the Alliance of Automobile Manufacturers, (Sacramento: September 22, 2004), http://www.deq.state.or.us/aq/aqplanning/CalLev/docs/SR20040904AppendixC_AAM.pdf.

design and manufacturing." But since the cost estimates were provided by companies that hope to sell the technologies, one might assume that the cost estimates were already somewhat optimistic.

- CARB assumed that some technologies (e.g., turbocharging; automated manual transmissions) would simultaneously reduce the cost of the vehicle and improve fuel economy. But if that were true, automakers would already be adding these technologies to vehicles voluntarily.
- CARB assumed that the fuel economy benefits of turbocharging could be achieved in cars running on regular gasoline, when in fact premium gasoline is required to achieve these benefits. The requirement to use more costly premium fuel erases all of the savings from turbocharging.

CARB estimated a net savings to motorists of $1,700 per car after full implementation of its fuel economy regulations. However, after accounting CARB's errors and erroneous assumptions, Sierra Research, a Sacramento consulting firm, estimated a net cost of about $3,100 per car due to CARB's fuel economy requirements.[17]

The LEV II fuel economy requirements will harm motorists in other ways as well. The fuel economy requirements effectively require automakers to divert their research and development efforts toward greater fuel economy than consumers would chose of their own volition and away from other vehicle attributes that consumers value more highly. Thus, fuel economy mandates are likely to decrease, from the motorist's point of view, the quality of the vehicles available for sale, when compared with a no-regulation scenario.

Rather than add technologies to increase fuel economy, it is also possible that automakers would simply sell fewer large automobiles. If this happened, many consumers would be unable to purchase the vehicle they would prefer. Instead, they would have to purchase a smaller vehicle, or hold on to their existing vehicle longer than they would otherwise choose. Once again, motorists would pay for the fuel economy requirements in the form of less useful and less satisfying automobiles.

Because fuel economy standards will make new automobiles both more costly and less desirable, motorists will hold on to their existing automobiles longer than they otherwise would. Since fleet turnover is the most important driver of automobile emissions reductions, the result is that fuel economy mandates *increase* future automobile emissions relative to where emissions would be in the absence of the mandate.

Taking account of the full welfare effects of the LEV II fuel economy requirements, NERA Economic Consulting estimated that CARB's fuel economy requirements

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[17] Ibid.

would reduce Californians' welfare by $4 billion per year in 2016, when the requirements are fully implemented.[18]

c. **How Pennsylvania's regulators and environmentalists created the appearance that LEV II would benefit motorists.** PennFuture claims "The Clean Vehicles Program [i.e., CA-LEV II] would not limit consumer choices. In fact, choices would increase as very clean, very fuel-efficient vehicles that are currently unavailable here would show up on Pennsylvania car lots."[19] PennFuture would have us believe that government regulations are necessary to get automakers to offer cars that motorists would prefer.

Secretary McGinty claims that comparison of cars for sale in nearby LEV II states demonstrates no difference in price or variety when compared with Pennsylvania's Tier 2 cars.[20] There are two fallacies here. First, the largest effects on cost and variety of vehicles won't occur until 2009, when the fuel economy standards come into effect. Comparisons of current automobiles do not provide any information on the future effects of the LEV II fuel economy mandates.

Second, in terms of air pollution, both Tier 2 and LEV II require that manufacturers meet a fleet average emissions level. Manufacturers can certify individual vehicles to any of a range of different standards, so long as the average vehicle meets the Tier 2 or LEV II limit. For example, Tier 2 has several numbered "bins," each with a different combination of VOC and NOx emissions limits. California has several emissions certification levels as well, for example, LEV (low-emission vehicle), ULEV (ultra LEV), SULEV (super ultra LEV), and PZEV (partial zero-emission vehicle). Each individual automobile must be certified to the specific requirements of one of the Tier 2 bins or LEV II categories.

The emissions limits of the various Tier 2 and LEV II certification categories overlap each other, but LEV II requires a slightly lower overall fleet average. This means that whether you look at a Tier 2 or a LEV II state, you'll see a large fraction of vehicles certified to essentially the same emissions levels, that cost roughly the same amount, and that could be sold in either LEV II or Tier 2 states. But in LEV II states manufacturers must sell a slightly larger fraction vehicles certified to the lower-emission categories and these vehicles cost more. Thus, even if sale prices directly reflected production and warranty costs, you'd never know by looking at individual vehicles that LEV II costs more than Tier 2. You have to look at the overall fleet mix sold in LEV II and Tier 2 states. A further complication, of course, is that manufacturers also have complex pricing strategies that make it even more difficult to figure out the true costs of different certification standards.

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[18] NERA Economic Consulting and Sierra Research, *Environmental and Economic Impacts of the ARB Staff Proposal to Control Greenhouse Gas Emissions from Motor Vehicles*, prepared for the Alliance of Automobile Manufacturers (Boston: September 2004).

[19] PennFuture, "Lemon Law."

[20] Kathleen McGinty, letter to Richard Geist, November 1, 2005.

3. **Additional misconceptions that have confused the Tier 2/LEV II debate**

   a. **Environmentalists and journalists have created a false impression of lax federal vehicle standards.** A recent PennFuture Action Alert begins "Pennsylvania has had a requirement on the books since 1998 to implement a clean car program. …However some legislators are threatening to scrap the whole program by enacting a bill to block it…"[21] Another alert claims "The federal [Tier 2] program…is much weaker than the Pennsylvania Clean Vehicles Program."[22] These claims create the false impression that Pennsylvania's cars will be high-polluters unless the state adopts CA-LEV II standards. Likewise, the Pittsburgh Post-Gazette claimed that preventing adoption of California standards "would torpedo the state's clean-air standards for vehicles" and "would harm the very air we breathe," creating the false impression that automobile emissions would rise under the federal Tier 2 requirements.[23]

   Ironically, back when Tier 2 was adopted and implemented, environmentalists couldn't heap enough praise on the program. For example, when EPA finalized the Tier 2 standards in 1999, the Clean Air Trust called them "historic" and "the crown jewel in the clean-air legacy of the Clinton-Gore administration."[24] A Natural Resources Defense Council press release highlighted the implementation of Tier 2 in January 2004, noting that "The [Tier 2] vehicles, which burn low-sulfur fuel, are 77 percent to 95 percent cleaner than current models."[25]

   Few people—including people who should know better—are aware of the spectacular improvements in automobile emissions that federal regulators have required during the last 30 years. Figures 5 and 6 display the trend in federal NOx and VOC emissions requirements, going from an uncontrolled automobile in the 1970s, to a Tier 2 vehicle today. If CA-LEV II requirements were placed on the graphs, they would almost exactly overlap the Tier 2 lines. Both Tier 2 and CA-LEV II automobiles are about 99% cleaner than cars built during the 1960s, and 75% to 95% cleaner than cars built during the late 1990s.

   In 20 years or so, when almost all automobiles on the road are Tier 2 automobiles, the average automobile will be about 90% cleaner when compared to today. The progressive improvement in emissions is even greater than the graphs suggest,

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[21] PennFuture, "Improve Health & Keep Gas Prices Low with PA Clean Cars Program," October 14, 2005, http://www.pennfuture.org/index.cfm?myPageName=items/index&action=List&pagename=Item&backpage=TopNew&area=news&catlist=alerts,e3,facts,session,green,press,reports,pennevents&category=alerts&id=1741.

[22] PennFuture, "Clean Cars for Pennsylvania," http://www.pennenvironment.org/PEair.asp?id2=21113, undated, but released in January 2006.

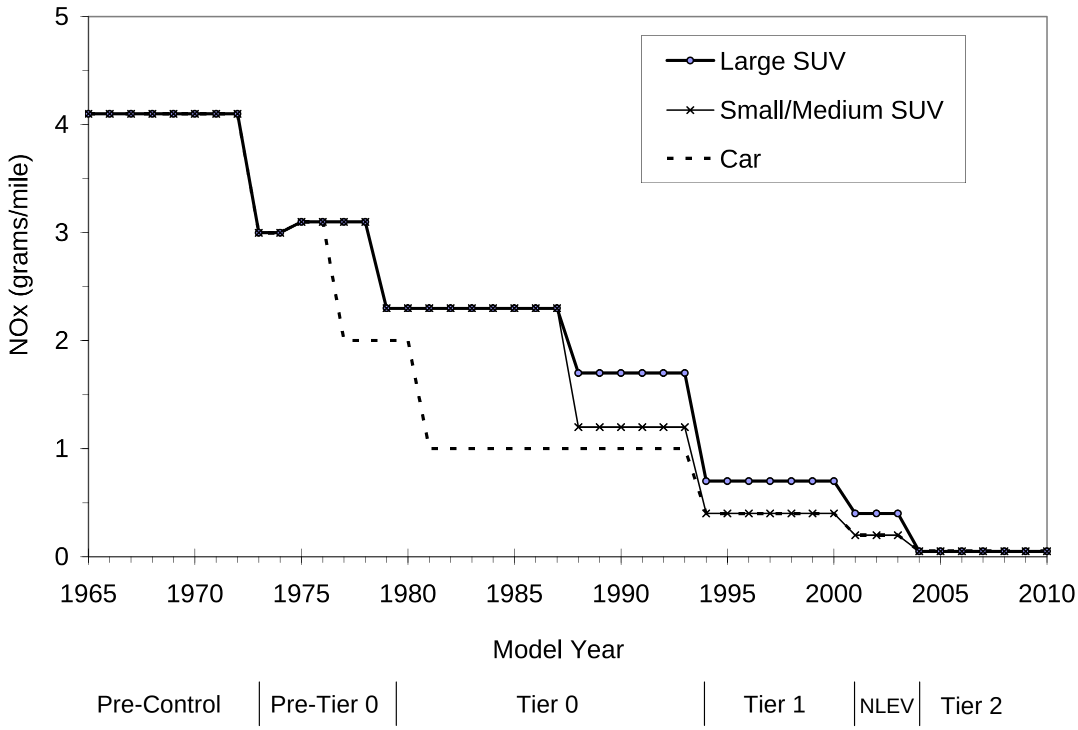
[23] Pittsburgh Post-Gazette, "Editorial: More dirty doings / Legislators blow smoke on clean air standards," November 10, 2005.

[24] Clean Air Trust, "Trust Hails 'Historic' Vehicle, Gasoline Cleanup Plan as 'Crown Jewel' in Clinton-Gore 'Clean-Air Legacy'," December 21, 1999, http://www.cleanairtrust.org/release.122199.html.

[25] Natural Resources Defense Council, "EPA Touts New Cleaner Cars," January 26, 2004, http://www.nrdc.org/bushrecord/2004_01.asp.

because more recent standards have also required low emissions to be maintained through higher ages and mileage, and Tier 2 also applies the “light-duty” standards to even the largest SUVs. Another way in which the real improvement is great than suggested by the graphs is that automobiles built to more-recent standards in general actually meet these standards on the road. On the other hand, back in the 1970s and 1980s, the typical car exceeded its emission caps on the road.[26]

Figure 5. Trend in federal NOx emission standards

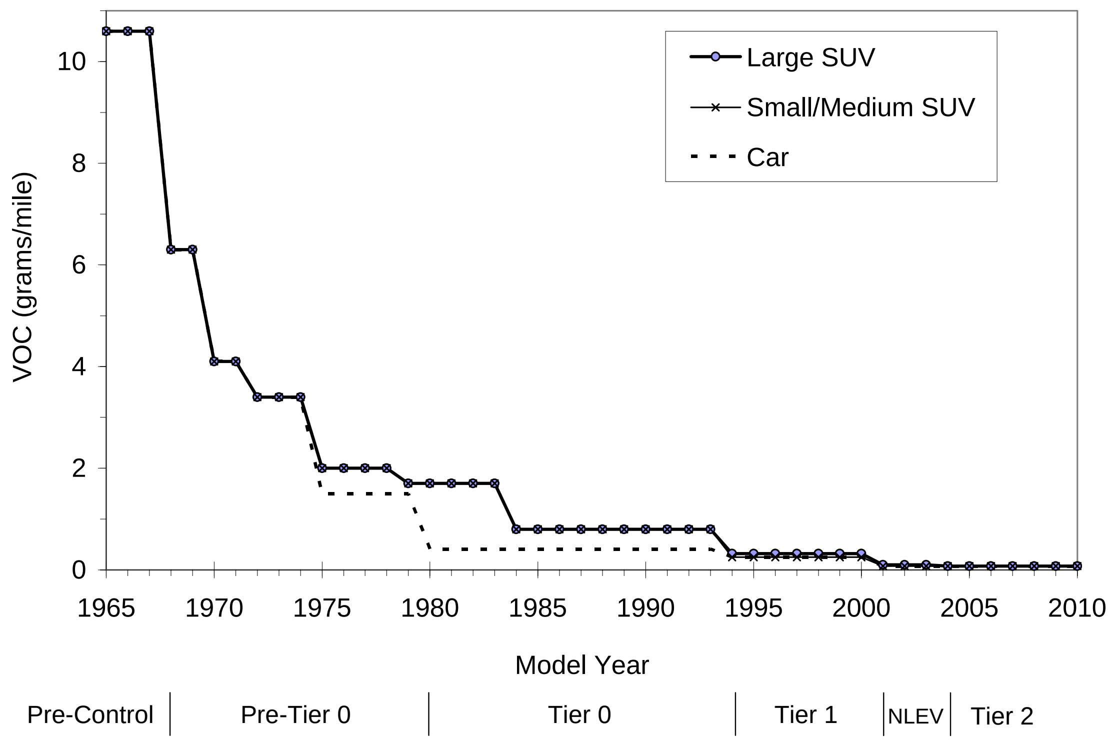


Notes: Standards shown here apply up to 50,000 miles. Tier 1 added standards that apply between 50,000 and 100,000 miles, while Tier 2 added standards that apply between 50,000 and 120,000 miles. Designations along the bottom refer to the names EPA uses to refer to each set of standards. The NLEV, or National Low-Emission Vehicle program, was implemented nationwide in 2001. However, nine northeastern states implemented NLEV in 1999.[27]

[26] Jake Kelderman, “Failure Rate High on Emission Gear,” *Automotive News*, May 13, 1985; General Accounting Office, *Pollution from Cars on the Road--Problems in Monitoring Emission Controls* (Washington, DC: February 4, 1977); General Accounting Office, *Better Enforcement of Car Emission Standards--a Way to Improve Air Quality* (Washington, DC: January 23, 1979).

[27] S. C. Davis and S. W. Siegel, *Transportation Energy Data Book: Edition 22* (Oak Ridge, Tennessee: Oak Ridge National Laboratory, September 2002), www-cta.ornl.gov/cta/data/Download22.html; Environmental Protection Agency, *Federal and California Exhaust and Evaporative Emission Standards for Light-Duty Vehicles and Light-Duty Trucks* (Washington, DC: February 2000), http://www.epa.gov/otaq/cert/veh-cert/b00001.pdf.

Figure 6. Trend in federal VOC emission standards

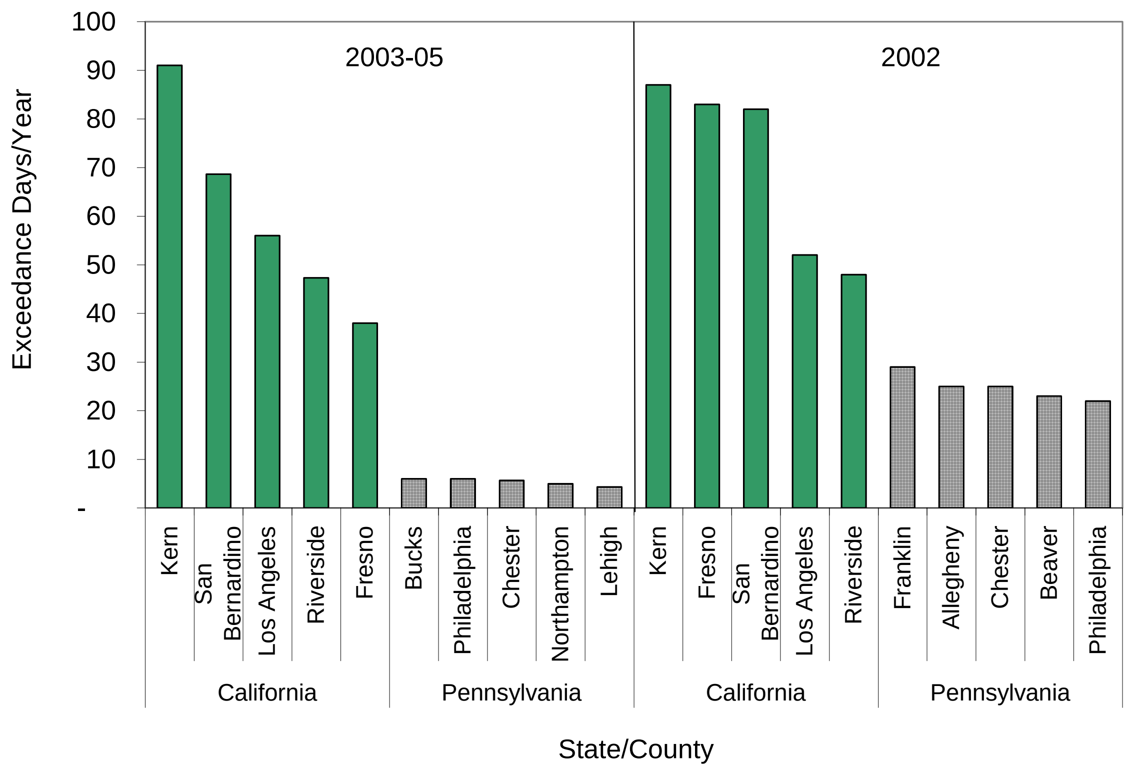


b. **Only California has air pollution like California.** Environmentalists have been trying to create the false impression that Pennsylvania's air pollution is similar to California's, presumably as one way to justify the need for California-style emission standards. For example, a recent PennFuture pamphlet claims "Like California, we are also dealing with serious air pollution problems."[28] But no area of the U.S. has air pollution similar to the worst air pollution in California. Figures 7 and 8 compare ozone and PM2.5 levels, respectively, in California and Pennsylvania.

For ozone it isn't even close. California has much higher ozone levels than Pennsylvania, and this was true even in 2002, which was an unusually high-ozone year in the eastern U.S. The disparity is even greater based on the old 1-hour ozone standard. All of Pennsylvania now complies with the1-hour standard. But the worst areas of California still exceed the 1-hour standard 10, 20, even 30 days per year.

[28] PennFuture, "Lemon Law."

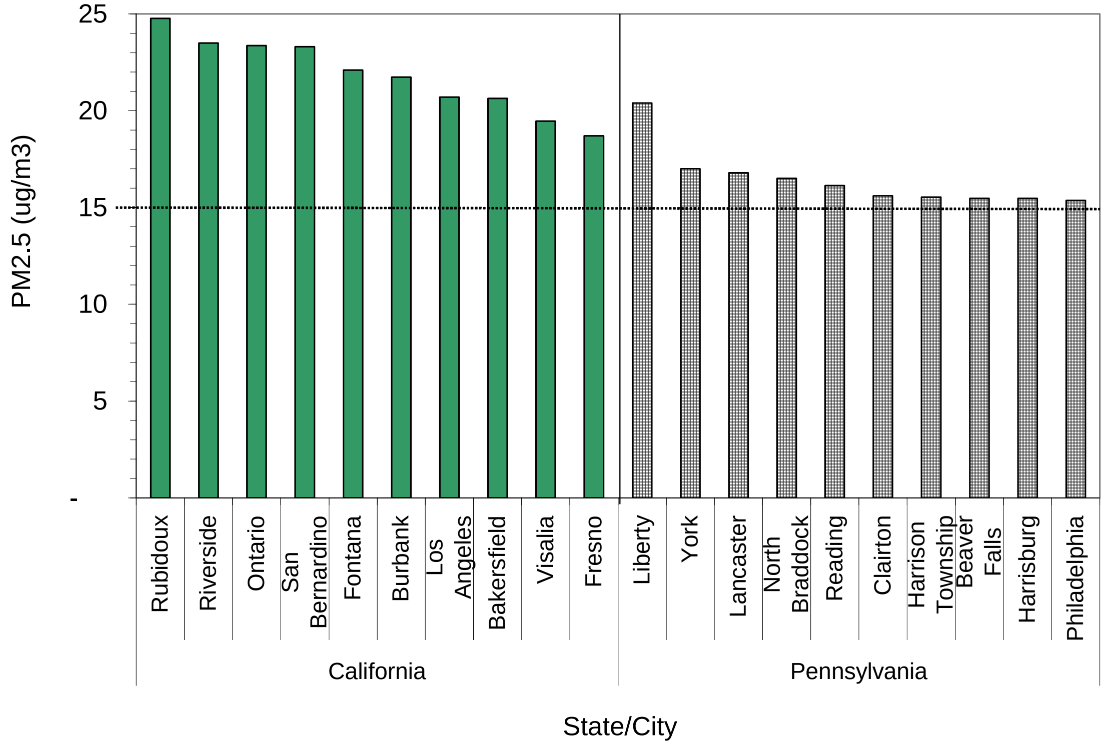
Figure 7. Days per year exceeding the federal 8-hour ozone standard in California and Pennsylvania. Comparison of 5 worst counties in each state for 2003-05 and 2002.



Note: Data are for the monitoring location in each county with the most ozone exceedance days. Data were downloaded from EPA at http://www.epa.gov/ttn/airs/airsaqs/ and http://www.epa.gov/air/data/geosel.html.

For PM2.5, Liberty, PA is the only Pennsylvania city that comes close to being in the same league as the worst areas of California. But even here, when compared with Rubidoux, the worst area in California, Liberty is already halfway to toward meeting the federal standard. Liberty's PM2.5 problem is also localized. The rest of the Pittsburgh metro area has much lower PM2.5 levels. The next highest PM2.5 in the Pittsburgh area is in North Braddock, which is relatively close to meeting annual PM2.5 standard. Half the monitoring locations in the Pittsburgh metro area already comply with the federal PM2.5 standard. This suggests that high PM2.5 in Liberty is due to local point sources, rather than regional motor vehicle emissions. In contrast, California's high PM2.5 levels are regional, and mainly a result of motor-vehicle emissions. For example, the worst seven cities in Figure 8 are all in the Los Angeles-San Bernardino-Riverside megalopolis.

Figure 8. Average annual PM2.5 levels in California and Pennsylvania. Comparison of 10 worst cities in each state for 2002-2004.

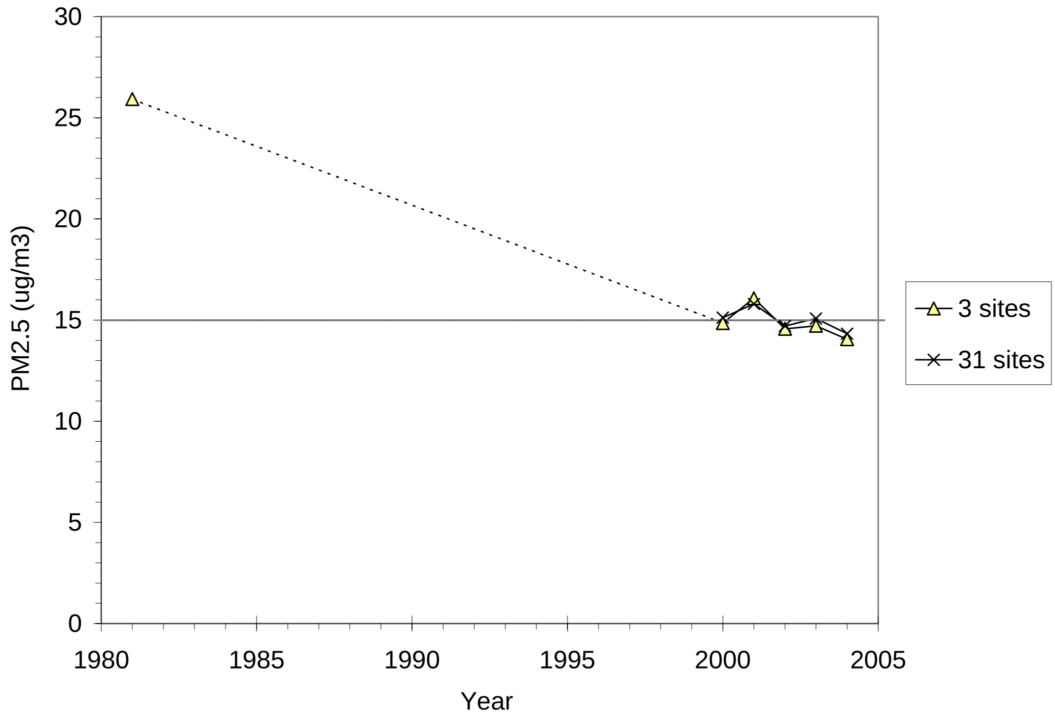


Note: The horizontal line marks the 15 ug/m3 federal standard. Data were downloaded from EPA at http://www.epa.gov/air/data/geosel.html.

c. **Getting real on air pollution trends.** I showed earlier that ambient levels of air pollutants directly emitted by automobiles have been dropping. Here I present trends in ozone and PM2.5. VOC and NOx emitted by automobiles help form these two pollutants. Yet Figures 9 and 10 show that PM2.5 and ozone have been declining as well, albeit somewhat more slowly than NO2 and CO. Average annual PM2.5 declined about 6% between 2000 and 2004 and 46% between 1981 and 2004. About 70% of Pennsylvania's PM2.5 monitors complied with the federal PM2.5 standard as of the end of 2004. As shown in Figure 8 above, with the exception of Liberty, all non-attainment locations are relatively close to meeting the standard.

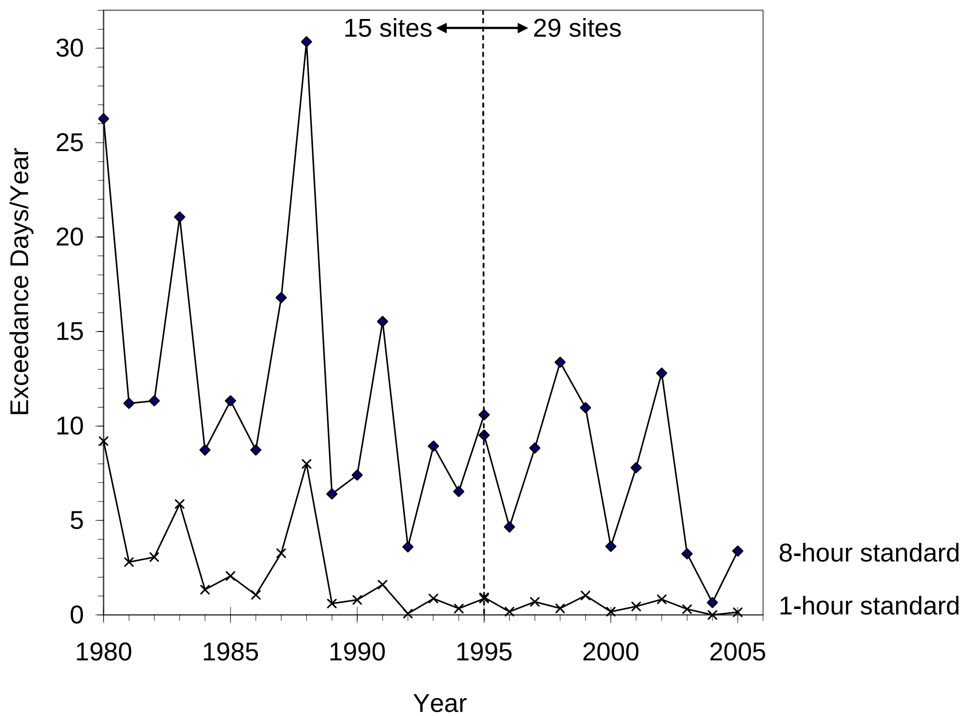
Ozone varies a great deal from year to year due to variations in weather (all else equal, ozone is higher during hot, dry, low-wind years). Despite large variations from year to year, ozone declined substantially in Pennsylvania from 1980 into the early 1990s. Ozone levels then rose for a few years and then leveled off for nearly a decade. Ozone dropped substantially during 2003-2005, which were the three lowest ozone years on record.

Figure 9. PM2.5 trends in Pennsylvania. Average annual PM2.5 levels at continuously operated monitoring sites, 1981-2004.



Notes: The horizontal line marks the annual PM2.5 standard. The 3 sites with data from 1981 are Philadelphia, Pittsburgh, and Bethlehem. These early data were collected during 1979-83 as part of EPA's Inhalable Particulate Network and were provided by Fred Lipfert. PM2.5 data for 2000-04 were downloaded from EPA at http://www.epa.gov/air/data/geosel.html.

Figure 10. Ozone trends in Pennsylvania. Average days per year exceeding the federal 1-hour and 8-hour ozone standards at continuously operated monitoring sites, 1980-2005.



Notes: Data were downloaded from EPA at http://www.epa.gov/ttn/airs/airsaqs/ and http://www.epa.gov/air/data/geosel.html.

The much lower ozone of the last few years has drastically reduced the extent of ozone non-attainment in Pennsylvania. Through 2003, about 80% of Pennsylvania's ozone monitors violated the 8-hour ozone standard. Thirty out of 32 counties with ozone monitors had at least one monitor that violated the standard. However, as of the end of 2005, only 18% of monitors in 9 counties violated the standard.

It isn't clear what the last three years mean for the long-term trend in ozone. 2004 had unusually mild and rainy weather, favoring lower ozone. On the other hand, 2005 was one of the hottest years on record, and yet ozone still remained at historically low levels. There have also been substantial reductions in ozone-forming emissions during the last few years, which should help keep future ozone levels lower. Time will tell.

Unfortunately, regulators, journalists, and environmental activists have been providing misleading information on air pollution trends. In fall 2005, after Pennsylvania had experienced its third lowest ozone level ever and its highest ozone attainment rate ever, a Pennsylvania DEP press release proclaimed "NUMBER OF

OZONE ACTION DAYS UP FROM LAST YEAR."[29] And despite the 70% drop in the number of counties violating the 8-hour ozone standard between 2003 and 2005, regulators, environmentalists, and newspaper editorialists continue to use the much higher 2003 numbers in their pro-LEV II activism.

d. **Pennsylvania must attain current federal air standards long before a change in automobile emission standards could affect air quality.** Secretary McGinty has claimed that Pennsylvania might not meet its Clean Air Act deadlines even with the CA-LEV II standards. At the joint legislative hearing on December 13, 2005, the Secretary stated "we most certainly cannot meet our attainment requirements with the Tier 2 program. And I would say even further, we won't make our attainment requirements with the [California] Air Resources Board standard."

In reality, whether Pennsylvania goes with Tier 2 or LEV II is irrelevant to whether the state can meet its Clean Air Act deadlines. Philadelphia has until 2010 to attain the federal 8-hour ozone standard.[30] Pennsylvania's other ozone non-attainment areas have until 2007 or 2009 to reach attainment. Even if Pennsylvania implemented CA-LEV II in 2008, the earliest year allowable, it would be more than a decade before a significant fraction of the (albeit tiny) incremental benefits would be realized, and two decades before the full benefits are realized. Thus, LEV II is irrelevant to Pennsylvania's ability to attain current federal air quality requirements by required deadlines.

However, if the Pennsylvania DEP was really focused on attaining the 8-hour ozone standard, the agency wouldn't be shooting for the miniscule, expensive, far-in-the-future emissions reductions from CA-LEV II. Instead, DEP would be trying to deal with the few percent of cars on Pennsylvania's roads right now that account for most of the state's automobile emissions. I discuss this issue in more detail below.

e. Meeting current and future air pollution standards. 2005 was one of the hottest years on record, yet the highest-ozone location in Pennsylvania had a fourth-highest 8-hour ozone level of 0.094 ppm—about 11% above the federal standard. The highest three-year average (which is how attainment is calculated) was 0.090 ppm, or only about 6% above the standard. Thus, even areas that violate the 8-hour standard don't have far to go to reach attainment.

Ozone is difficult to reduce, even with large reductions in ozone-forming pollutants (VOC and NOx), and it is likely that several areas of the country will not be able to reach attainment within the few years allotted. But this shouldn't cause us to lose sight of the fact that huge emission reductions are coming down the pike in next two decades from all pollution sources. Indeed, this is another factor that has been missing from the Tier 2/LEV II debate. In addition to the large reductions in automobiles, EPA has also adopted regulations that will eliminate almost all remaining emissions

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[29] Pennsylvania Department of Environmental Protection, "NUMBER OF OZONE ACTION DAYS UP FROM LAST YEAR," September 28, 2005, http://www.ahs.dep.state.pa.us/newsreleases/default.asp?ID=3643&varQueryType=Detail.

[30] For a list of non-attainment areas and deadlines, see http://www.epa.gov/oar/oaqps/greenbk/gnc.html.

from power plants (>70% reduction), diesel trucks (>80% reduction, net of growth), off-road diesel vehicles (>80% reduction, net of growth), dozens of industries, and many other smaller pollution sources. These large reductions will likely be sufficient for Pennsylvania to ultimately reach statewide 8-hour ozone attainment as well as PM2.5 attainment.

However, EPA recently proposed a tougher PM2.5 standard and is considering a tougher ozone standard. Current requirements might or might not be sufficient to attain these new standards. Regardless, instead of making decisions in the dark, the Legislature should insist that DEP provide urban airshed modeling of expected ozone and PM2.5 levels after already-adopted pollution-control requirements are fully implemented. While this modeling should include separate Tier 2 and LEV II scenarios, the results probably won't provide much enlightenment. Whatever the real air quality differences between Tier 2 and LEV II, they will be far smaller than the uncertainties in the modeling itself.

Even if it appears that Pennsylvania will need additional emission reductions to attain future air pollution standards, this isn't an argument for adopting CA-LEV II. As already described, LEV II also includes expensive fuel economy requirements. If more stringent automobile pollution standards are necessary to attain tougher ozone and PM2.5 standards, they will be necessary not only in Pennsylvania, but in the entire northeast, midwest, and southeast. Rather than saddle Pennsylvanians with the high costs of CA-LEV II, the state would be better served by staying with the lower-cost federal emission standards. EPA will probably have to tighten those standards anyway if it adopts a tougher ozone standard. Since EPA's standards would focus only on air pollution, rather than fuel economy, they would likely be less costly to consumers than CA-LEV II.

f. **Dialing down the rhetoric on air pollution and health.** Health is the primary justification for air pollution requirements. A full discussion of health effects is beyond the scope of these comments.[31] But I do want to provide a taste of the extent to which regulators, activists, and the media have exaggerated air pollution's health effects.

I use asthma as an example. Because asthma can be a frightening disease, and because so many children have been diagnosed with it, asthma is probably the health issue most frequently mentioned in connection with air pollution advocacy. A number

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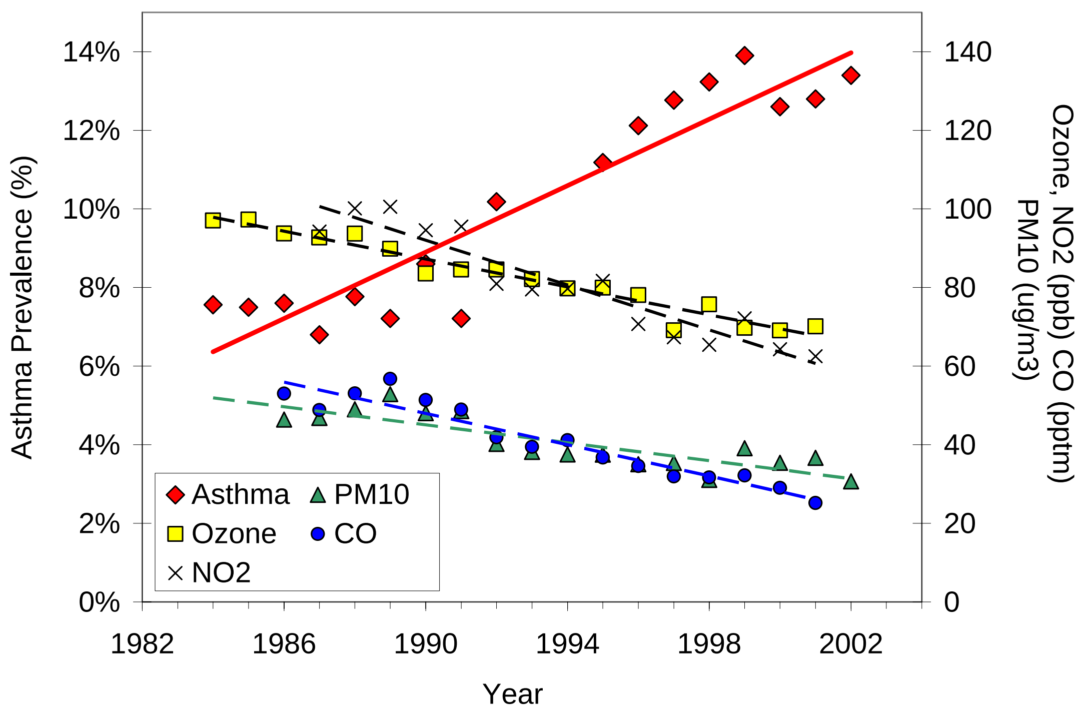
[31] But for a critical look at health effects claims, see, for example, L. C. Green and S. R. Armstrong, "Particulate Matter in Ambient Air and Mortality: Toxicologic Perspectives," *Regulatory Toxicology and Pharmacology* 38 (2003): 326-35; G. Koop and L. Tole, "Measuring the Health Effects of Air Pollution: To What Extent Can We Really Say That People Are Dying from Bad Air?" *Journal of Environmental Economics and Management* 47 (2004): 30-54; F. W. Lipfert, "Commentary on the HEI Reanalysis of the Harvard Six Cities Study and the American Cancer Society Study of Particulate Air Pollution and Mortality," *Journal of Toxicology and Environmental Health, Part A* 66 (2003): 1705-14; T. Lumley and L. Sheppard, "Time Series Analyses of Air Pollution and Health: Straining at Gnats and Swallowing Camels?" *Epidemiology* 14 (2003): 13-4; S. H. Moolgavkar, "A Review and Critique of the EPA's Rationale for a Fine Particle Standard," *Regulatory Toxicology and Pharmacology* 42 (2005): 123-44; J. Schwartz, *Rethinking the California Air Resources Board's Ozone Standards* (Washington, DC: American Enterprise Institute, September 2005), http://www.aei.org/doclib/20050912_Schwartzwhitepaper.pdf.

of editorials and activist action alerts have created the impression that people with asthma will be seriously harmed if Pennsylvania fails to adopt CA-LEV II requirements. Leaving aside for the moment the fact that air pollution will drop substantially under either Tier 2 or LEV II, Figure 11 shows that air pollution is not a plausible cause of asthma.

Figure 11 displays the trend in asthma prevalence in California, along with California trends in CO, NO2, ozone, and PM10 (I've shown California data, because I wasn't able to locate asthma trend data for Pennsylvania). Note that asthma prevalence has been rising as air pollution of all kinds has been declining. I included only four pollutants to keep the graph from becoming too busy. Other pollutants California measures have been declining as well: PM2.5, diesel soot, benzene, 1,3-butadiene, perchloroethylene, hexavalent chromium, lead, and many more. The story is the same in all other states with data on long-term asthma trends—declining air pollution; rising asthma.

Figure 11. Trend in asthma prevalence vs. air pollution levels in California



Notes: The lines are linear regression lines. Ozone, CO, and NO2 are the average of the top 30 daily readings for each year (ozone and CO peak 8-hour, NO2 peak 1-hour) across all monitoring sites for the given pollutant. PM10 (particulate matter under 10 microns in diameter) is the average of the annual-average PM10 readings for all monitoring sites. Only sites with data in every year throughout the time period for each pollutant were included in the analysis. Number of monitoring sites for each pollutant: NO2=57, CO=47, Ozone=68, PM10=29. Pollution declined not only on average, but at almost every individual monitoring site. The start of the time period (which ranges from 1984-1987) for each pollutant was chosen to maximize the number of monitoring sites included, while still overlapping the time period during which asthma prevalence rose. CO is listed in parts per ten million (pptm; divide by 10 in order to get parts per million) so that CO values fall within the same range as other pollutants. ppb = parts per billion; ug/m3 = micrograms per cubic meter. Ozone data are from California Air Resources Board, *2003 Air Pollution Data CD*, http://www.arb.ca.gov/aqd/aqdcd/aqdcd.htm. Asthma prevalence data were provided by the California Department of Health Services.

While air pollution isn't a plausible cause of asthma, it does have the potential to exacerbate preexisting asthma. Nevertheless, the effect is small. For example, based on recent CARB estimates, eliminating virtually all human-caused ozone in California would reduce asthma-related emergency room visits among asthmatic children by about 1.8%.[32] In other words, ozone accounts for a tiny fraction of asthma-related health effects, even in a state where much of the population lives with much higher ozone levels than Pennsylvanians.

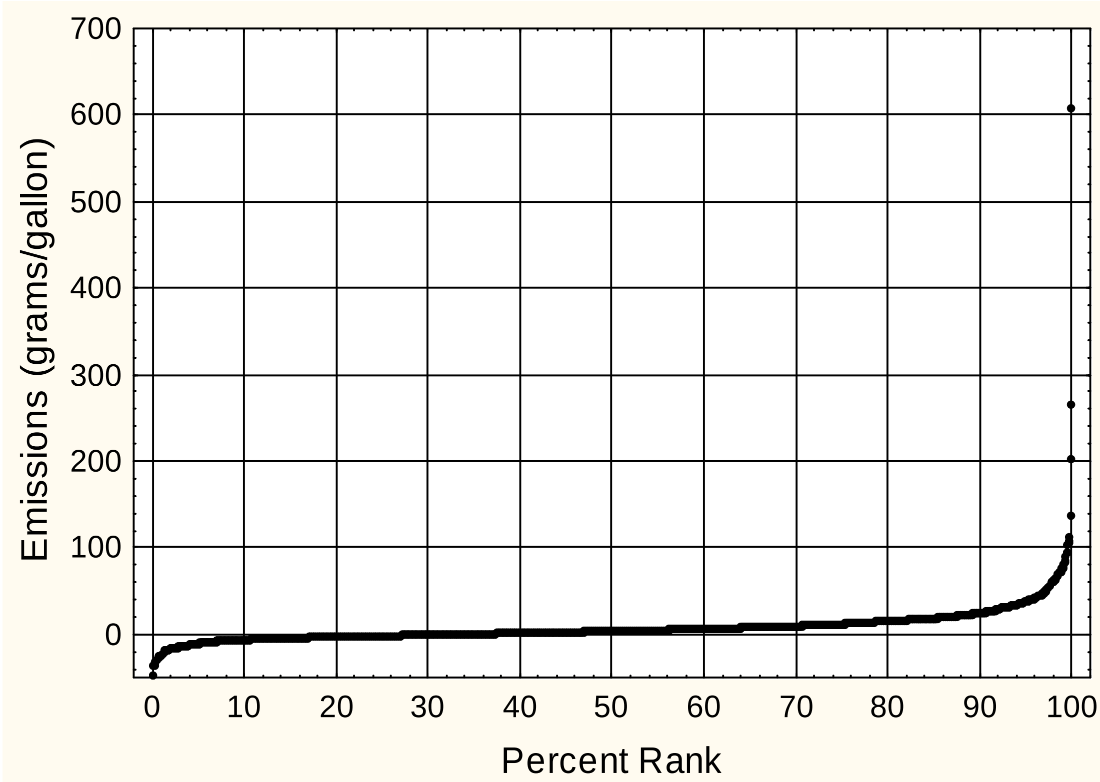
4. **Pennsylvania is ignoring the cheapest and quickest means of reducing automobile air pollution.** A great irony of the Tier 2/LEV II debate is that regulators, environmentalists, and journalists claim to want LEV II out of a concern for air quality, yet they have ignored an approach that could inexpensively achieve many times the incremental pollution reductions available from LEV II, and within the next couple of years, rather than 10 or 20 years down the road. Researchers have long known that a small fraction of all automobiles produces most pollution from automobiles.[33] For example, for VOC, the worst 5% of automobiles produces about 50% of all VOC emissions; for NOx the worst 5% produces about 35%.[34] These "gross polluters" are on the road in spite of the existence of vehicle inspection programs. Figure 12 displays the distribution of VOC emissions, based on data collected in Chicago in 2000. Note that most automobiles produce hardly any VOC emissions, while a few percent have enormous emissions. This skewed emissions distribution is typical of automobiles all over the United States.

[32] CARB provided an estimate of the number of asthma ER visits avoided by ozone reductions, as well as the total rate of asthma ER visits due to all causes in the California population. From this information, plus data on the total size of the relevant population one can calculate the percentage reduction in asthma ER visits due to ozone reductions. California Air Resources Board, *Review of the California Ambient Air Quality Standard for Ozone* (Sacramento: March 2005), http://www.arb.ca.gov/research/aaqs/ozone-rs/ozone-final/ozone-final.htm; Schwartz, *Rethinking the California Air Resources Board's Ozone Standards*.

[33] D. R. Lawson, P. J. Groblicki, D. H. Stedman et al., "Emissions from in-Use Motor Vehicles in Los Angeles: A Pilot Study of Remote Sensing and the Inspection and Maintenance Program," *Journal of the Air & Waste Management Association* 40 (1990): 1096-105; D. H. Stedman, *Remote Sensing: A New Tool for Automobile Inspection & Maintenance* (Denver: Independence Institute, January 2002), http://www.feat.biochem.du.edu/assets/reports/Ind_Inst_IM_position_1_2002.pdf; L. G. Wayne and Y. Horie, *Evaluation of ARB's In-Use Vehicle Surveillance Program, Final Report* (Sacramento: California Air Resources Board, October 1983).

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

Figure 12. Distribution of On-Road VOC Emissions in Chicago in 2000



Notes: Emissions are in units of grams of VOC emitted per gallon of gasoline burned. Data are presented for 1,643 vehicles measured at least twice by on-road remote sensing. Data were collected by Don Stedman and Gary Bishop, University of Denver, and were downloaded from http://www.feat.biochem.du.edu/light_duty_vehicles.html.[35]

The data in Figure 12 were collected with an on-road measurement device called a remote sensor, which was invented in the late 1980s by researchers at the University of Denver. Remote sensing could be used to identify the highest-polluting few percent of automobiles as they drive on the road.[36] These cars could then be repaired or scrapped. Many of the motorists who drive these gross polluters are relatively poor. Thus, the state could subsidize the cost of repairs, or offer motorists a cash incentive if they are willing to scrap their car. The program could be funded by exempting newer cars (say, cars up to 8 or 10 years of age) from the state's vehicle inspection program and having the exempted motorists instead pay an annual registration surcharge of $5 or $10. This

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[35] For additional details, see Ibid.

[36] S. Diaz, D. R. Lawson, D. E. Schorran et al., *Follow-up to Orange County Vehicle Emissions Study* Desert Research Institute, April 29, 1996); D. R. Lawson, S. Diaz, E. M. Fujita et al., *Program for the Use of Remote Sensing Devices to Detect High-Emitting Vehicles, Prepared for the South Coast Air Quality Management District* (Reno: Desert Research Institute, April 16, 1996); J. Schwartz, *Remote Sensing of Vehicle Emissions: State of the Technology, Potential Applications, Cost Estimates, and Recommendations* (Sacramento: California Inspection and Maintenance Review Committee, September 1998); Stedman, *Remote Sensing: A New Tool for Automobile Inspection & Maintenance*.

program would not affect emissions 20 years from now, as the Tier 2 standards will take car of the long-term vehicle emissions problem. But in the short term, finding and repairing or scrapping gross polluters has the potential to eliminate as much as 30% or 40% of current automobile emissions at a relatively low cost.