Comments on EPA's Draft Report *MOBILE6 Inspection/Maintenance Benefits Methodology for 1981 through 1993 Model Year Light Vehicles, M6.IM.001*

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1) EPA, page 4: *12. High Emitter Waiver Rate - Selected to be 15 percent of failures, and loosely based on analysis of Arizona and Ohio I/M vehicles.*

Comment: This rate is too high; Arizona and Wisconsin report waiver rates of 4 percent of all failures.

2) EPA, pages 10 and 11: *Line D represents the average emissions of the portion of high emitting vehicles that are identified and repaired because of the I/M process. This line is calculated as a function of vehicle age, and is a percentage (e.g., 150%) of Line B. The portion of the fleet which is identified by I/M will be repaired to a lower level on average. However, this level is not as low on average as the average of the normal vehicles. The justification for this assumption was an analysis of Arizona IM240 before and after repair data collected during 1995 and 1996.*

and

EPA, page 20: *The normal emitter emission level is used as the final after repair emission level if it is larger than the calculated after repair emission.*

Comment: LBNL analysis of Arizona IM240 data finds the same result, that average emissions of seemingly repaired vehicles are not brought down to the level of vehicles that pass their initial test (Wenzel, 1999a). Figures 1 though 3 show the factors necessary to adjust average emissions of initially passing vehicles to the average emissions of vehicles that failed initial but passed final I/M testing in the Arizona program in 1996-97, compared with the factors EPA is proposing for MOBILE 6. In general the factors are quite similar, although EPA's factors are slightly higher, particularly for HC and CO.

3) EPA, pages 12 and 13: in –use deterioration regression coefficients for normal emitter cars.

Comment: The curves for the different age groups of each fuel technology (FI and Carb) are roughly parallel (see Figures 4 through 9). However, all FI categories have higher slopes than all Carb categories. This means that at high mileages FI vehicles have higher emissions than carbureted vehicles. For instance, 1988-93 TBI and PFI HC emissions exceed 1986-89 Carb HC emissions around 80,000 miles (Figure 4). At 150,000 miles, HC emissions are: 0.26 TBI, 0.23 PFI, and 0.20 Carb. This does not make sense; a 1993 PFI is supposed to be much more durable than a 1986 Carb. If anything, the FI vehicles should have smaller slopes, in line with manufacturer claims (and evidence from IM240 data) that newer TBI and PFI technology vehicles have much less emissions deterioration than older FI and Carb technologies. In addition, for cars the CO PFI curve is much higher than the TBI curve. There is anecdotal evidence from some manufacturers that early PFI technology had problems to be worked out; however, this should not affect all years of PFI. The NOx deterioration rates for carbureted light trucks (Figure 9) have a very high intercept, and a very small slope. These rates suggest that these vehicles experience very little emissions deterioration as they accumulate mileage.

4) EPA, page 14: *The high emitter HC emission level for the 1988-93 MY PFI group is also a special case. For this group it was thought that the average high emitter emission level was too low because it caused the average high emitter level to be lower than the normal emitter level at fairly low mileages. It was increased from 1.10 g/mi HC to 1.74 g/mi HC by adding one very high emitting 1987 model year vehicle to the 1988-93 model year PFI group.*

Comment: The rationale for moving a vehicle into this group does not make sense. Based on the coefficients in Table 1a, a 1993 PFI car with 150,000 miles would have HC emissions of 0.16 gpm, which is much less than the 1.1 gpm mean emissions of high emitter cars.

5) EPA, page 14: *An analysis of the Ohio IM240 data was also done to try and estimate the high emitter levels for running LA4 and start emissions. This was done because of the small numbers of high emitters in the EPA and AAMA FTP (running LA4 and Start) data samples. In this analysis, a large sample of Ohio vehicles were segregated into normal and high emitters, and the average high emitter emission levels were determined and compared with the FTP based estimates. They compared favorably. However, the analysis was plagued with uncertainties such as how to separate the normals from the highs when FTP data are not available, the inability to split PFI from TBI in the Ohio IM240 data, …*

Comment: The VIN does not consistently distinguish between different fuel delivery systems; consequently, the only way to determine the fuel delivery system of a particular vehicle is to visually inspect the vehicle. VIN decoders attempt to identify the type of fuel system for individual vehicle models; however, such decoders are subject to error (for instance, one such decoder identifies late 1980s Hyundai Excels as fuel injected, whereas they used carburetors during those years). In addition, VIN decoders typically do not distinguish among different fuel injection systems. EPA should review certification records, or survey manufacturers, to determine what fuel system was installed in different years of each vehicle model.

6) EPA, page 15: *Because of these problems the Ohio IM240 data were not used to estimate the average high emitter emission levels.*

Comment: There are recognized problems with IM240 data, as EPA notes. However, these data provide emissions information on a huge, relatively unbiased, sample of vehicles. EPA should consider examining multiple years of IM240 data in order to check its conclusions on in-use deterioration based on FTP data. EPA should compare the results from the Ohio IM240 data with those from other state IM240 programs (Arizona, Colorado, and Wisconsin). An analysis of other state IM240 data would include any cumulative effect of basic I/M programs on in-use emissions. However, evidence indicates that basic programs may not have had a dramatic cumulative effect on in-use emissions.

7) EPA, page 19: Table 2c.

Comment: The report should state clearly that the average after repair HC levels in Table 2c exceed the HC cutpoints. Was this really the case? If trained mechanics cannot repair HC emissions to below the IM240 cutpoints, this has important implications for I/M program effectiveness.

8) EPA, pages 22 and 23: Table 2f, Technician Training Emission Effects

Comment: The percent different between the "after repair by Master Tech" and "after repair by Student Tech" should not be considered the effect of technician training on repair effectiveness. Rather, the Master Tech levels should be considered the maximum emissions reduction potential of vehicle repair. EPA should find some other way to simulate the effect of technician training on repair effectiveness.

9) EPA, page 24: *Because no analysis has yet been conducted on data from operating IM240 programs to estimate the after I/M emission level of vehicles which were waived from the requirement to pass the test, an assumed reduction percentage will have to be used, or the individual user will have to provide a value. The default value will be a 20 percent reduction from the high emitter line for all pollutants.*

and

EPA, page 4: *10. Waiver Repair Levels - In MOBILE6, cost waivered I/M failures will get some repair benefit. A value of a 20 percent reduction has been chosen.*

Comment: Gordon-Darby tracks the average emissions levels by model year of vehicles that receive waivers in the Arizona I/M program, from the 2% random sample of vehicles that received a full IM240. These could be compared to the emissions of intial pass vehicles, to determine how much higher emissions from waived vehicles are from emissions of initial pass vehicles. Other IM240 states may have similar data.

10) EPA, page 25: *For the model year groups of 1981-82 and 1983-85 HC and CO emissions, it was found that the base emission factors at higher mileage levels become higher than the average emissions of the high emitters. It occurs because at high mileages the basic emission factors are data extrapolations. However, under the structure of the model, this is not possible, and it implies that the fleet contains more than 100 percent high emitters. To overcome this inconsistency, it was assumed that the average base emission factors could not continue to rise after it reaches the average of the high emitters, and that it would be set to the average of the high emitters. Typically, the cross-over point is between 150,000 and 200,000 miles, and after this point is reached, it is assumed that the percentage of highs in the fleet for this model year group / technology is 100 percent. This flattening of the emission factor line at very high mileages is consistent with some remote sensing studies. A physical explanation would be that while some surviving vehicles continue to deteriorate, the worst emitters are progressively scrapped out of the fleet in the high mileage range.*

Comment: This assumption essentially assumes that no early-1980s vehicles are normal emitters. In the Arizona program, about half of the 1981-85 cars with odometers between 150,000 and 200,000 miles passed tailpipe testing, using start-up cutpoints. The normal vehicle deterioration rate should be adjusted, perhaps on the basis of analysis of IM240 data, so that the average emissions of normal vehicles at high mileage are less than the average emissions of high emitters.

11) EPA, page 27: *In the MOBILE6 model, the non-compliant vehicles will be represented as a fraction of the identified high emitters that did not pass or receive a cost waiver. A default value of 15 percent will be built into the model for the non-compliance rate…As an approximation, it is assumed that the 15 percent non-compliance rate (from above) includes the effect of high emitters which did not show up for their first test.*

and

EPA, page 4: *11. High Emitter Non-Compliance Rate - Set to a default value of 15 percent. MOBILE6 will offer users the ability to enter alternative values. This is a generous default which is based on extensive analysis of Arizona and Ohio I/M vehicles. The analysis suggested higher rates (> 20 percent). It also includes high emitters which do not show up for the initial I/M test.*

Comment: LBNL's analysis of Arizona IM240 data indicates that 30 to 40% of vehicles that fail their initial I/M test do not eventually receive a passing result (Wenzel, 1999a; Wenzel, 1999b). Even accounting for the 4% of all vehicles that fail initial testing that receive a waiver, the EPA estimate of 15% appears to be low. Analysis of remote sensing data indicate that 25% of these vehicles are still being operated in the I/M area more than 2 years after their last I/M test (Wenzel, 1999b). A significant portion of vehicles may not be reporting even for initial I/M testing. Analysis of two years of IM240 data in Arizona indicates that 40% of the vehicles tested in 1995 did not report for testing in the next I/M cycle (1997). Remote sensing data indicate that about 40% of these vehicles were still being driven in the I/M area at least two years after their 1995 I/M test (Wenzel, 1999b). This suggests that 16% of all vehicles avoided initial I/M testing during the second cycle of the Enhanced Arizona program.

The default noncompliance rate in the MOBILE6 model should be a conservative estimate (that is, a higher rate should be the default rate), in order to encourage states to gather data in support of a more accurate noncompliance rate.

12) EPA, page 31: *Existing evidence suggests that the type of problems which cause I/M failures can re-occur as often in the repaired vehicles as they do in the unrepaired fleet. Thus, it is assumed that the fleet, after repair, will have the same emission deterioration as before repairs.*

Comment: Nearly 40% of the vehicles that failed initial testing, and passed final testing, in 1995 failed initial testing in 1997. This suggests that repaired vehicles have a greater probability of failing subsequent I/M testing than initially passed vehicles. (The repeat failure rate increases by vehicle age, with over 40% of MY81 cars failing their initial 1997 I/M test, and 15% MY94 cars failing their initial 1997 test. Of the repeat failures, about half failed for the same combination of pollutants in each test year.) (Wenzel, 1997c) An analysis of the Colorado IM240 program found a similar high percentage of vehicles repeatedly failing their initial I/M test in subsequent years (ENVIRON, 1998). Similar analyses of multiple test cycles of other state I/M programs can be performed to determine the repeat failure rate in other states.

13) EPA, Figure 2A, Annual I/M Credits Sawtooth.

Comment: The figure suggests that the initial emissions reduction after introduction of an I/M program is dramatically larger than the emissions reductions of subsequent I/M cycles. The figure also suggests that the effect of the I/M program is to offset nearly all of the increase in emissions due to deterioration from increasing mileage. An analysis of the cars that were tested in both 1995 and 1997 of the Arizona IM240 program suggests a different picture of the effect of the I/M program (see Figure 10, below, and attached memo). Here the initial reduction from the first cycle of the Enhanced program is equivalent to the reduction from future cycles. (The Phoenix area had a Basic program in place prior to implementation of the Enhanced program, which could have muted the effect of the Enhanced program. On the other hand, subsequent cycles of the Enhanced program achieve roughly the same emissions reduction as the first cycle.) In addition, the effect of two years of emissions deterioration outweigh the effect of emissions repairs, such that the after repair emissions in 1997 are substantially higher than the after repair emissions in 1995. Figure 2A may be illustrative only; EPA should determine if the results obtained from MOBILE6 look like those in Figure 10, and, if not, make adjustments to the model assumptions. Again, tracking individual vehicles over multiple I/M cycles can be performed for I/M programs in other states.

14) EPA, page 64: *Neither the Idle Test or the 2500RPM/Idle test will produce NOx benefits or NOx "Dis-benefits" for MOBILE6. In comparison, MOBILE5 contained NOx "Dis-benefits" if an Idle or 2500RPM Idle test were performed.*

Comment: The assumption in MOBILE5 that a basic I/M program that tested for HC and CO only would result in an increase in NOx emissions is a good one. Studies of repair effectiveness typically indicate that repairing for HC and CO only can lead to increases in NOx emissions. EPA should describe on what basis they are recommending removal of NOx disbenefits for programs not testing for NOx.

References

ENVIRON, et al. 1998. Performance Audit of the Colorado AIR Program, prepared for the Office of the State Auditor, State of Colorado, March.

Wenzel, Tom. 1999a. "Evaluation of Arizona's Enhanced I/M Program", presentation to National Research Committee to Review MOBILE Model, Irvine, CA, March 4.

Wenzel, Tom. 1999b. "Tracking Vehicles over Time in the Phoenix I/M Program", draft memo, April 16.

Wenzel, Tom. 1999c. "Evaluation of Arizona's Enhanced I/M Program", presentation at the 9th CRC On-Road Vehicle Emissions Workshop, San Diego, CA, April 21.

Figure 1. HC After Repair Adjustment Factors by MY
Proposed MOBILE6 vs. 1996-97 Arizona IM240

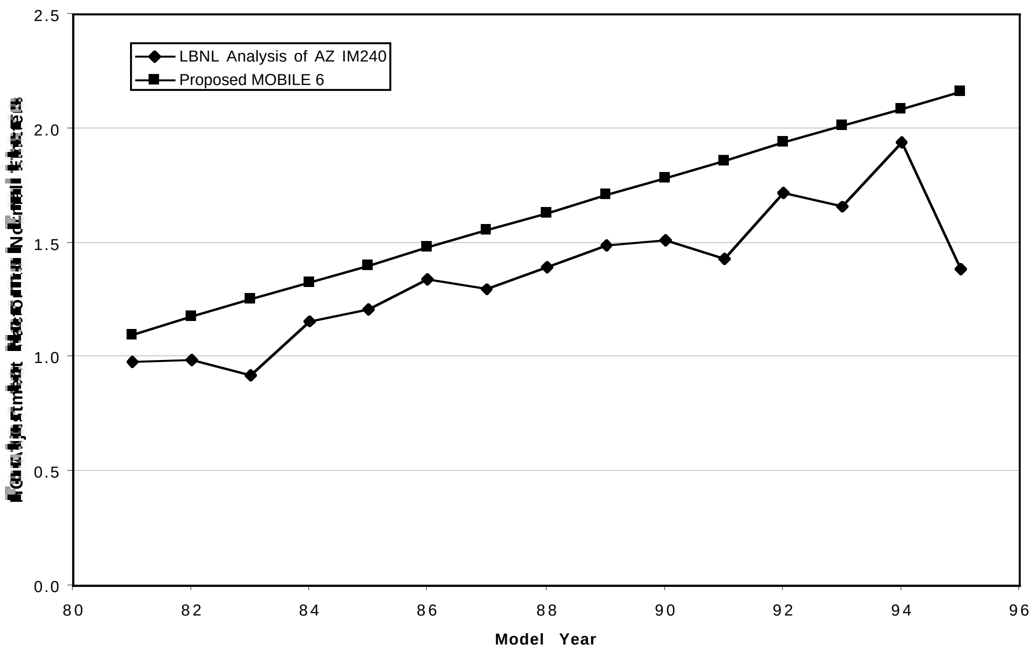

Figure 2. CO After Repair Adjustment Factors by MY
Proposed MOBILE6 vs. 1996-97 Arizona IM240

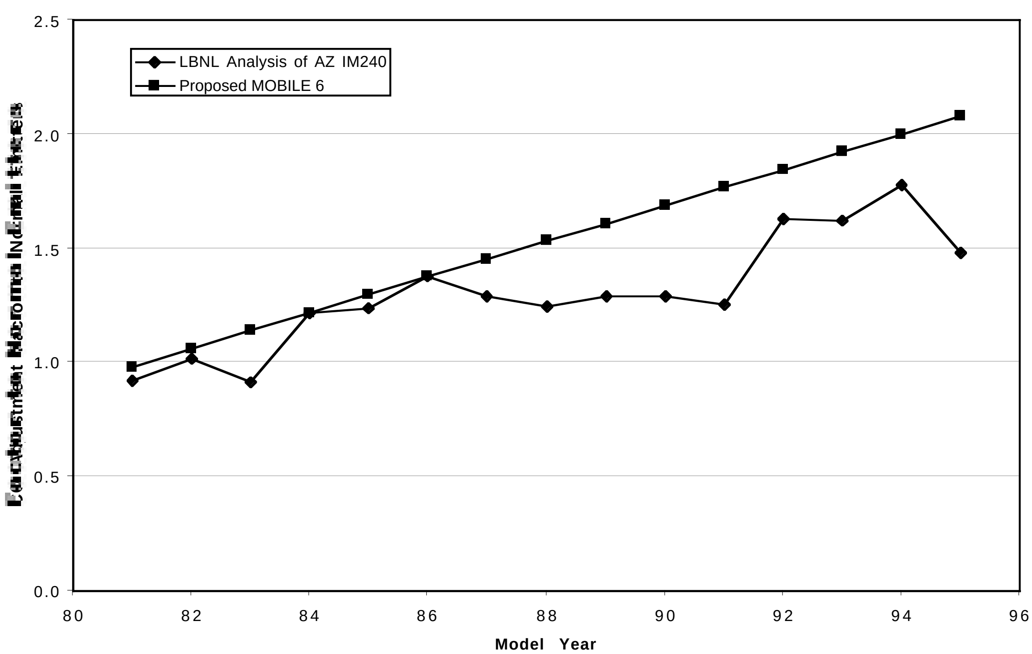

Figure 3. NOx After Repair Adjustment Factors by MY
Proposed MOBILE6 vs. 1996-97 Arizona IM240

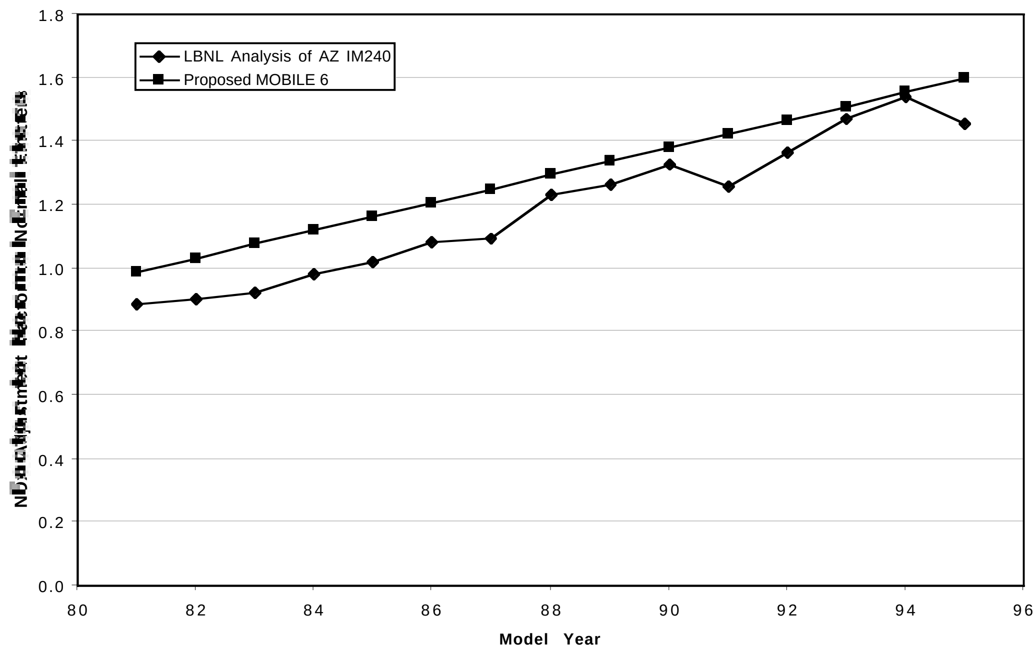

Figure 4. Proposed MOBILE6 HC Deterioration Rates, Cars

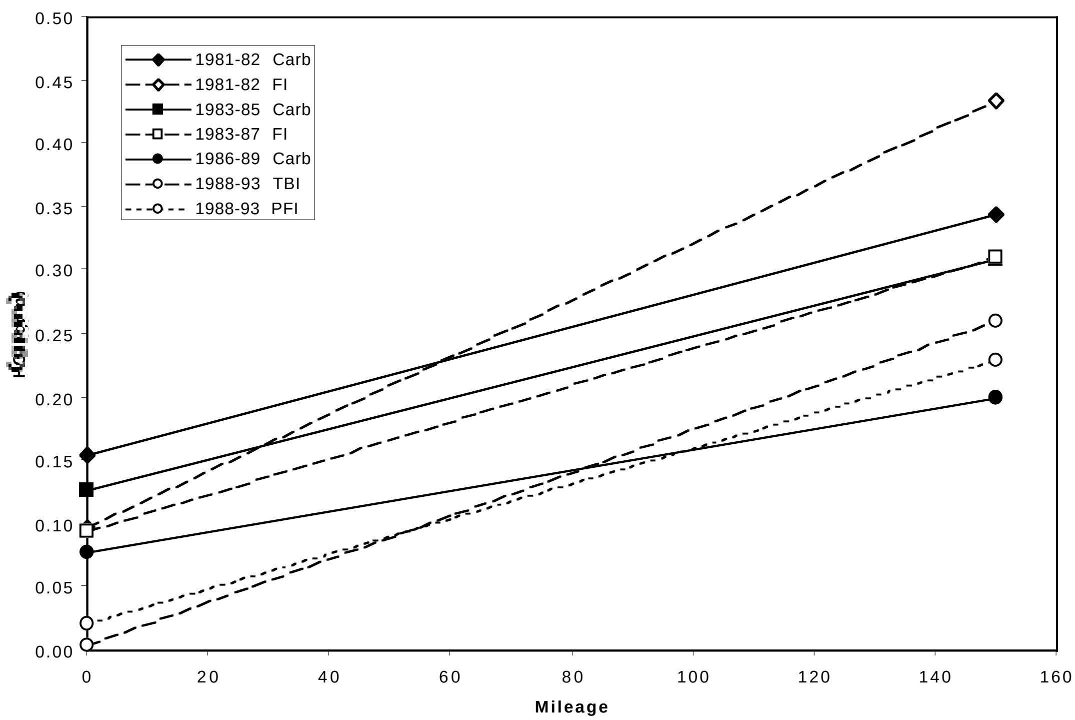

Figure 5. Proposed MOBILE6 CO Deterioration Rates, Cars

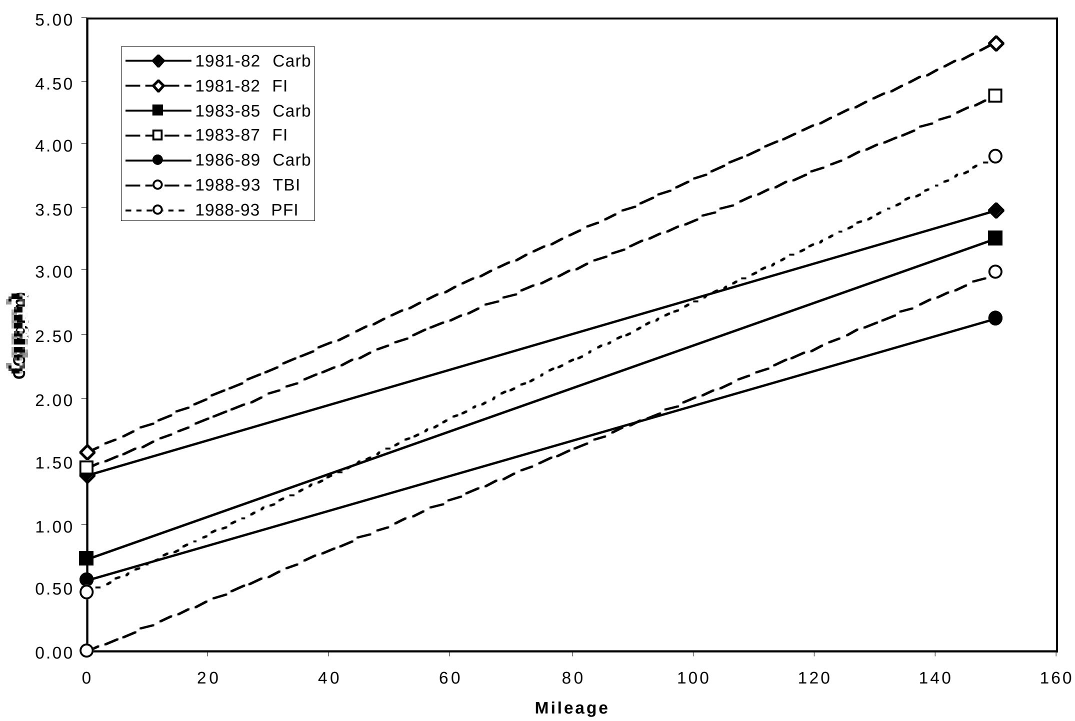

Figure 6. Proposed MOBILE6 NOx Deterioration Rates, Cars

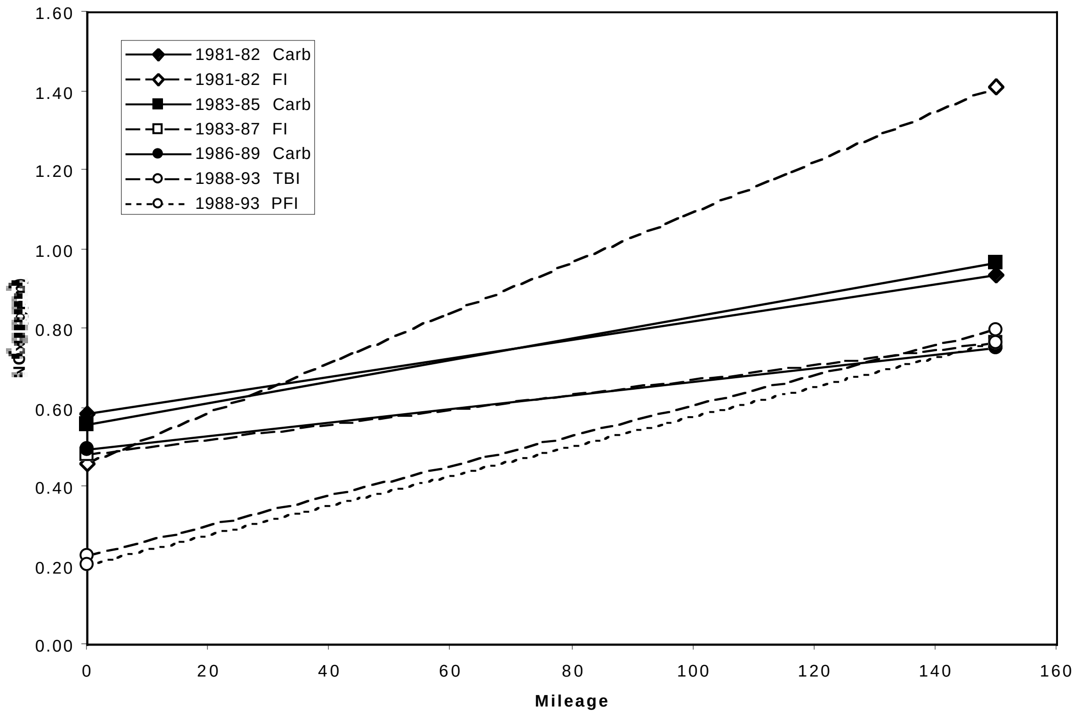

Figure 7. Proposed MOBILE6 HC Deterioration Rates, Light Trucks

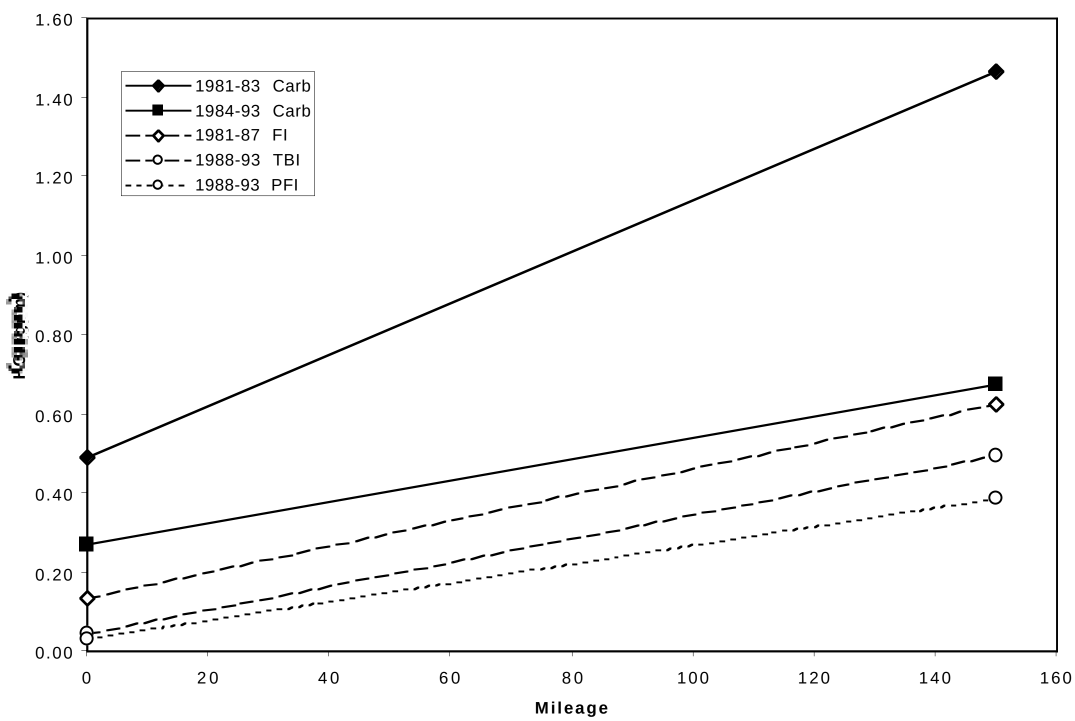

Figure 8. Proposed MOBILE6 CO Deterioration Rates, Light Trucks

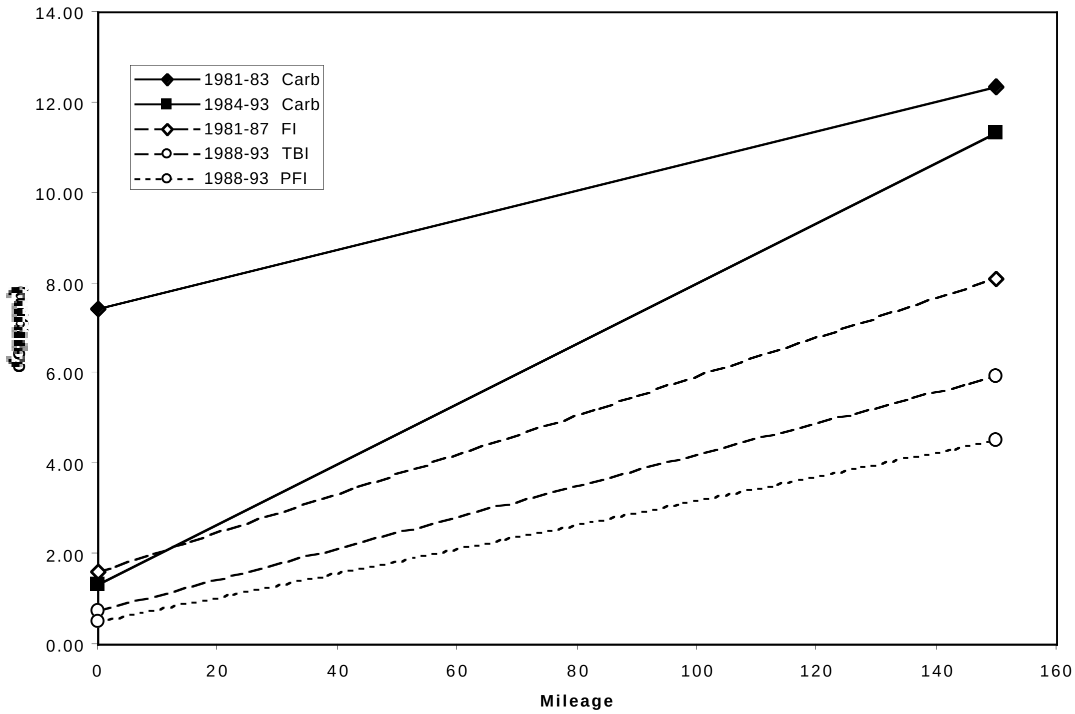

Figure 9. Proposed MOBILE6 NOx Deterioration Rates, Light Trucks

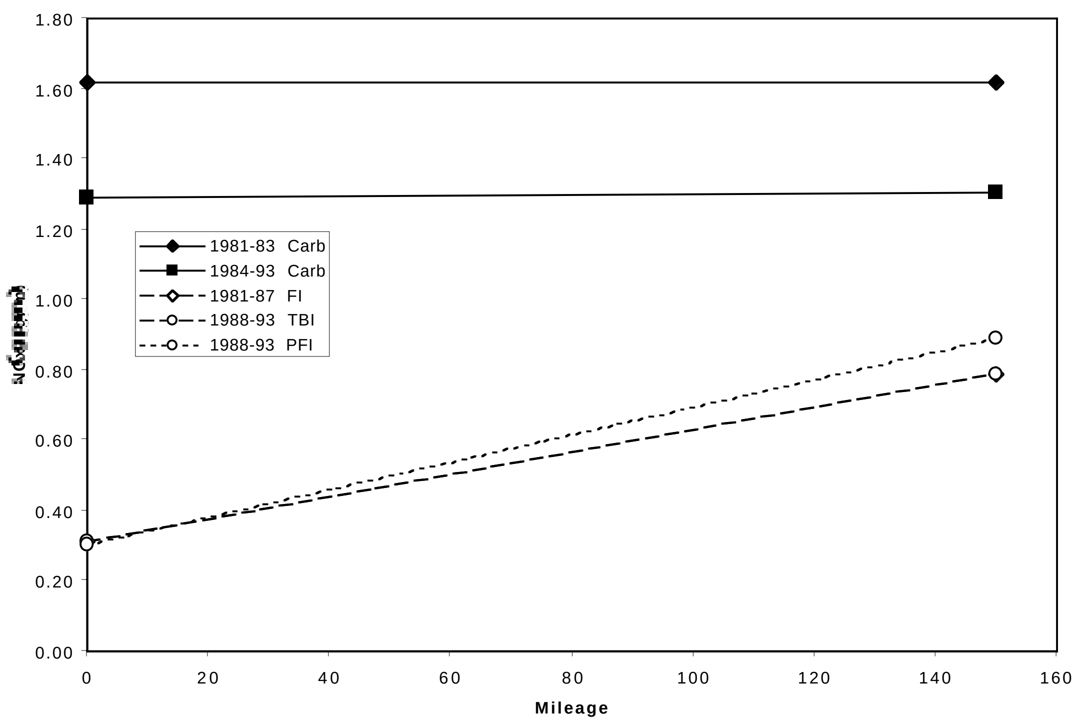

Figure 10. Annual I/M Credits Sawtooth

Passenger Cars, 1995 and 1997 Arizona IM240