

**EPA Proposal for Effects of  
Onboard Diagnostic Systems (OBD-II) in MOBILE6**

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M6OBD2.WPD

**Abstract**

MOBILE5a and previous versions of the model have not attempted to directly account for any in-use benefits of onboard diagnostic (OBD) systems. With the implementation of new final rules at the Federal level for second-generation OBD systems (OBD-II), MOBILE6 will include some explicit modeling of the assumed benefits of such systems. As discussed below, there are essentially no in-use data on which to base these initial estimates of benefits; thus, a number of assumptions will need to be made. This second proposal (the first proposal, dated March 14, 1997, can be found with other proposals presented at the March 1997 MOBILE6 workshop, see the OMS Web site modeling page at <http://www.epa.gov/omswwww/models.htm>) lays out in more detail how we intend to go about estimating these benefits, highlights the areas in which in-use data are needed, and indicates specific areas where input from stakeholders is most important in assisting us in reaching a decision on an approach to this issue in MOBILE6.

**Summary of the Proposal**

EPA proposes that the recommendation of the Modeling Work Group (part of the Mobile Source Technical Advisory Subcommittee of the Clean Air Act Advisory Committee) regarding this issue be used in MOBILE6. This recommendation is to use the general approach developed by the California Air Resources Board (ARB) for use in the EMFAC series of emission factor models, with appropriate modifications to reflect the differences in the details of the regulations applicable to OBD-II systems at the Federal and California levels. The Modeling Work Group (MWG) recommendations are cognizant of the lack of data for modeling these benefits in the MOBILE6 development time frame, and indicate the desirability of EPA making its own assumptions about OBD-II effectiveness and vehicle owner response to illumination of malfunction indicator lights (MILs).

**Supporting Data**

Federal OBD-II requirements are being phased in over the mid- to late-1990s for light-duty gas vehicles and light-duty gas trucks. Hence, although a relatively small number of LDGVs and LDGTs equipped with OBD-II systems are currently part of the in-use fleet, the fraction is so small and the average age/mileage of such vehicles so low that no in-use performance data are currently available for analysis in the development and programming of MOBILE6. EPA is planning to implement a significant testing program effort over the coming

two years; details of this proposed testing are being worked out by the Regional and State Programs Division (RSPD), with the cooperation of the Assessment and Modeling (AMD) and Testing Services (TSD) Divisions. When sufficient data on the in-use performance of OBD-II equipped vehicles have been collected and analyzed, EPA will modify the assumptions made concerning (and hence the emission reduction estimates attributable to) OBD-II systems as indicated by such data and analysis. For the current model revisions (MOBILE6), EPA has considered the comments and suggestions provided since the March 1997 MOBILE6 workshop, and seeks additional input from stakeholder over the coming months as noted.

### Planned Data Collection Efforts

There are several data collection efforts planned by EPA and by other parties that will provide needed data; however, it currently appears that useful information to be derived from these efforts is not likely to be available until after the completion and release of MOBILE6 late next year.

- EPA is contracting with Automotive Testing Laboratories (ATL) to test 20 vehicles, selected with "natural" failures.
- The California Air Resources Board (ARB), the University of California-Riverside's CE-CERT laboratory, and the automotive manufacturers may all be collecting data in this time frame that will be useful to EPA.
- EPA is contracting with Sierra Research (January-June 1998) to perform OBD-II testing at two high-volume inspection and maintenance (I/M) program lanes in Wisconsin
- EPA is also monitoring the implementation of OBD-II checks in Davis County, Utah, and in Colorado and Oregon

While all of these efforts will likely provide useful data for refining and improving the assumptions made in modeling OBD-II benefits, the majority of relevant data will not be available in time for use in the development of the initial release of MOBILE6. Revisions to the modeling of OBD-II effects will be implemented as required based on new information obtained and analyzed after MOBILE6. Depending on the progress of these programs, it may be that some data will be available for consideration in modifying EPA's initial approach to modeling OBD-II before the final release of MOBILE6. Thus, this is one area where changes in the approach used and assumptions made could occur between the time that a beta version of MOBILE6 is released next summer and the final version is released late next year. EPA will allow time for outside review and comment with respect to any changes in the modeling of OBD-II effects that may be proposed between the beta and final versions of the model.

If readers of this document are aware of other data collection efforts planned or under

consideration over the next two years, they are encouraged to contact EPA (email: mobile@epamail.epa.gov) to provide more information about those programs.

## **Methodology**

### Goal

The goal is to provide consistent, logical, and defensible estimates of the emission reductions that can be attributed to the implementation of OBD-II systems. Such estimates need to cover both exhaust (tailpipe) and evaporative (non-tailpipe) sources of emissions, and must be developed for both areas with and without operating I/M programs.

### Estimates to be Made

The overall estimates to be made are, to what extent will OBD-II systems prevent the migration of vehicles from the “normal” emitter category to higher emitter categories for exhaust emissions, and to what extent will OBD-II systems prevent increases in the fraction of vehicles modeled as failing either a functional purge or pressure test of the evaporative emission control system. Underlying those estimates will be a number of more specific estimates, which will be modified over time as data are collected and analyzed. Those influencing factors are discussed below.

EPA offers the following proposals for comment:

1. During the “bumper-to-bumper” warranty period (5 years/50,000 miles), EPA proposes that MOBILE6 assume that OBD-II systems will prevent all but a small residual population of vehicles from leaving the “normal” emitter category for exhaust emissions and from evaporative emission control system failures (i.e., all but a small residual fraction of vehicles will pass both purge and pressure tests through 5 years/50,000 miles). In other words, OBD-II will result in a nearly 100% reduction in the rate currently assumed for vehicles migrating upward over exhaust emission categories, and a nearly 100% reduction in the rate currently assumed for purge/pressure test failures of evaporative control systems. (The concept of the “residual” vehicle population as a function of the average time between MIL illumination and repair is discussed below.) This is essentially the same approach as is used by ARB in modeling OBD-II effects during the “full warranty coverage” period.
2. During the following period, from 5 years/50,000 miles to 8 years/80,000 miles (Federal warranty coverage for catalytic converter and engine computer controls), EPA believes that there may be some benefits attributable to OBD-II. The MOBILE6 program code will be developed and structured so as to allow modeling of some benefits in this “intermediate” period, though given the inavailability of data at this time and the data collection efforts planned over the next year (and beyond) EPA is not making a specific

proposal for the magnitude of benefits in this intermediate period at this time. The extent to which OBD-II will result in benefits over this intermediate period will be kept open as long as possible in order to use the best data that become available in time for consideration. As noted earlier, EPA would provide opportunity for review and comment on any proposal for modeling benefits in this intermediate period, even if a specific proposal is not developed until after release of the beta version of the model next summer.

3. EPA proposed that after expiration of all warranty coverage (i.e., after 8 years/80,000 miles), the rates of increase in the above-“normal” emitter category for exhaust emissions and in the rates of purge/pressure test failures will be modeled as unchanged from current assumptions. That is, while the fraction of vehicles in emitter categories greater than “normal emitters” and the fraction of vehicles failing purge/pressure evaporative system tests will be much lower at 8 years/80,000 miles than is currently assumed in the absence of OBD-II, as a result of assumptions 1 and 2 above, the rates at which these fractions increase will be the same rates as are currently used in the model after 8 years/80,000 miles.

As noted, a number of factors will influence the rates at which currently assumed rates of growth in above-“normal” emitter categories and in purge/pressure test failure rates will be reduced by OBD-II systems. As data become available to address these influencing factors, the broad estimates outlined above will be modified accordingly. Among these influences to be determined are:

- To what degree will OBD-II requirements result in vehicle designs which experience fewer emission control problems in use?
- At what rate will OBD-II systems detect and notify the vehicle owner (by MIL illumination) of emission control problems that result in the vehicle's exhaust emissions exceeding 1.5 (or, 1.75, depending on the component being monitored and the applicable emission standards) times the applicable emission standard?
- At what rate will OBD-II systems detect and notify the vehicle owner of problems that have a significant adverse impact on evaporative emission control systems (including enhanced systems incorporating onboard refueling vapor recovery (ORVR) systems)?
- At what rates will owners respond to the illumination of MILs during the full warranty period? At what rate will owners respond to MILs during the “partial” warranty period? And at what rate will owners respond to MILs after expiration of all emission control system warranties?
- Given the rates of owner response to MIL illumination in each of the three distinct periods of time/mileage, at what rate will effective repairs (i.e., repairs that reduce

emissions back to “normal” levels) be made?

- What will the average “lag time” be between MIL illumination and owner response and effective repair? Even during the period of full warranty coverage, it is unrealistic to assume that all owners will go to their dealership and get effective repairs the same day that an MIL is illuminated. Depending on the warranty coverage in effect and other factors (e.g., does the problem causing the MIL illumination also have an impact on driveability or vehicle performance), there will be some average delay time between MIL illuminations and repairs. This delay time will result in there being a small “residual” fraction of vehicles on the road at any given point in time that have illuminated MILs (and hence are presumed to have emission performance problems) that have not yet been addressed. The longer this “lag time” is on average, the higher this residual fraction of the vehicle population will be (although in all cases, the number of so-called “residual” vehicles will be much lower than the currently modeled fraction of vehicles with emission performance problems).

Answers to these questions that are based on actual data will take some time to be developed. EPA is seeking input from all stakeholders on the questions posed in the preceding paragraphs.

It appears that in light of the substantially reduced estimates of average in-use deterioration that are to be included in MOBILE6, the treatment of OBD-II in MOBILE6 in the case of Tier 1 vehicles in non-I/M areas will have relatively little impact on overall emission levels, even if EPA does include modeling of some benefits in the intermediate period, as noted under (2.) above.

### **Stakeholder Comments on OBD-II**

Extensive comments have been provided to EPA concerning the modeling of OBD-II systems and estimation of associated emission reductions by Air Improvement Resources (AIR), representing the American Automobile Manufacturers Association (AAMA). The Modeling Work Group, established as a subpart of the Mobile Source Technical Advisory Committee, has also provided EPA with a summary of their recommendations as to how OBD-II should be modeled in MOBILE6. The main points made in these comments are summarized below:

- OBD-II benefits and I/M program credits must be logically consistent, and the best means of accomplishing that is to use the same modeling tool to develop both estimates.
- The CALIMFAC model, used by California ARB to develop benefit estimates for OBD-II systems and I/M program credits, would be an appropriate modeling algorithm ("accounting structure") for EPA to use in development of these estimates for MOBILE6.

- The assumptions that are necessary for modeling these benefits in the absence of in-use performance data should be clearly stated. Federal warranty provisions are only one of several relevant differences between California and the other 49 states, and such difference should be identified and reflected in the estimates of OBD-II benefits that are eventually used in MOBILE6.

Given the newness of OBD-II system requirements and the time necessary to collect and analyze real-world data pertinent to addressing these issues, sufficient data to address these issues will not be available for use in MOBILE6. EPA is hopeful that at least some relevant and useful data will become available between now and early 1998, which would allow the basic assumptions outlined above to be modified if needed for the initial release of MOBILE6. As discussed in the next section, a number of other aspects of MOBILE6 will need to be completed before actual numerical estimates of OBD-II benefits can be derived; thus, some modification of the basic assumptions above may be implemented before MOBILE6 is released.

### **Interaction with Other Issues**

Before actual estimates of the emission reductions associated with OBD-II systems can be developed, there are other aspects to the revisions included in MOBILE6 that must first be resolved. For example, the reassessment of in-use deterioration of exhaust emissions is likely to result in significantly different basic emission rate equations being used in MOBILE6 for 1981 and later model year light-duty vehicles and light-duty trucks. EPA is also considering modifying the approach used to model exhaust emitter categories; rather than the currently used discrete categories (normal, high, very high, super emitters), we are considering modeling emission rates as a distribution, with a “line” drawn at some point on the x-axis that separates “normal” emitters from “above-normal” emitters. The shape of that distribution and the point at which this line is drawn will help to determine how much benefit can be expected from systems, such as OBD-II, that are intended to prevent vehicles from exceeding what are defined as “normal” emission levels.

The interaction of OBD-II and inspection and maintenance (I/M) programs is also yet to be addressed. While in theory the “maximum” benefits available from OBD-II should be at least as large as the benefits of a stringent, well-designed IM240 program, or perhaps even larger, there is no way at this time to determine how close OBD-II will actually come to reaching those levels of emission reduction. Clearly there is still much information that we do not have and many questions to be addressed before numerical estimates of OBD benefits can be developed. The data collection efforts outlined earlier in this document should assist in refining and improving these estimates and the underlying rationale for them. EPA continues to seek the input of all stakeholders on addressing all of the questions raised in this discussion.