OUTLINE OF REGULATORY PROPOSAL (NPRM) FOR MANUFACTURER-RUN IN-USE HEAVY-DUTY VEHI CLE NTE TESTING PROGRAM

May 9, 2003

OBJECTIVES

The goal of this program is to generate data on in-use emissions of heavy-duty on-highway diesel engines that can be used by EPA, CARB, and diesel engine manufacturers to ensure that emission standards are met throughout the useful life of 2007 and later model year heavy-duty on-highway diesel engines under conditions normally experienced in-use. The program is intended to monitor for NTE compliance and to help ensure overall compliance with emission standards. These objectives can be met through a robust program that measures the full range of emissions from heavy-duty on-highway diesel vehicles operating in their normal daily routines.

PROGRAM DESIGN OVERVIEW

This is a two-phase testing program using onboard, mobile emission testing devices; initiation of the second phase of testing is conditional on the results of the first. The first phase will be used to determine if a designated heavy-duty on-highway diesel engine family requires any additional confirmatory testing beyond an initial test sample of 5 to 10 vehicles. If the engine family satisfies the Phase 1 testing criteria, no further testing or other data relating to that diesel engine family will be required from the manufacturer that year under this program. EPA/CARB may reopen an engine family if it obtains data indicating that nonconformities may be occurring. Additionally, the family may be selected in a later year for testing at higher mileage. If a heavy-duty on-highway diesel engine family does not satisfy the Phase 1 testing criteria, EPA/CARB will provide the manufacturer an opportunity to present additional data, and will then engage in discussions with the manufacturer to determine a course of action depending on the significance of the issues indicated by the Phase 1 testing and any supplemental data. The course of action might include, but not be limited to, one of the following:

- No further action (while not satisfying the Phase 1 testing criteria, significant issues with the heavy-duty diesel engine family are not indicated by the data);
- Require the engine manufacturer to conduct Phase 2 testing if 5 or more of the Phase 1 test vehicles do not satisfy the Phase 1 vehicle pass criteria unless the manufacturer agrees with EPA/CARB that some form of remedial action is warranted;
- If EPA/CARB and the engine manufacturer agree, have the manufacturer voluntarily conduct Phase 2 testing if 3 or 4 of the Phase 1 test vehicles do not satisfy the Phase 1 vehicle pass criteria; or
- Pursue some form of remedial action, if warranted, based on the limited data from Phase 1 testing alone or in conjunction with Phase 2 testing, and based on other relevant data and considerations.

PHASE 1 PROGRAM ELEMENTS

Sample Size

Phase 1 sample size: 5-10

If 5 out of 5 or 5 out of 6 vehicles in the Phase 1 test sample satisfy the vehicle pass criteria, testing of the designated heavy-duty on-highway diesel engine family at issue will stop and the manufacturer will not be required to take any further action or to submit any further data to EPA/CARB under the in-use NTE testing program for that designated engine family in that calendar year. If more than one vehicle out of the Phase 1 test sample of six vehicles does not satisfy the vehicle pass criteria, four additional vehicles shall be tested.

Vehicle Pass Criteria

If 90% or more of the valid NTE sampling events on a time-weighted basis are at an emission level that is less than or equal to the NTE Threshold, the test vehicle meets the vehicle pass criteria. Additionally, the in-use testing program will include the following vehicle pass/fail criteria for MY2007 through MY2009 vehicles: 100% of the NTE sampling events must be less than two times (2X) the NTE Threshold for all measured regulated pollutants, except that vehicles certified to a NOx FEL equal to or less than 0.50g/bhp-hr must have 100 % of the NOx NTE sampling events less than 2X the NTE Threshold or less than 2.00g/bhp-hr, whichever is greater At this time, the in-use testing program will not include a maximum NTE sampling event emission level as a vehicle pass/fail criteria for model years after 2009. Instead, EPA/ARB will evaluate the need for, and level of, any such vehicle pass/fail criteria for MY2010 and later engines based, for example, on data from the in-use NTE testing program and other relevant test programs. EPA/CARB will initiate a subsequent rulemaking if the agencies decide it is appropriate to establish such a vehicle pass/fail criteria for MY2010 and later engines.

A valid NTE sample shall consist of engine operation in the NTE control area for at least 30 seconds and shall include the entire NTE event until the engine drops out of the Control Area as defined by existing regulations. The average emissions for each valid sampling event will be calculated by dividing the total mass of emissions emitted during the duration of the NTE event by the work done during the NTE event. Each of the valid events then will be time-weighted. In addition no single sampling event may be treated as being more than 600 seconds in duration for time-weighting purposes, or by more than 10 times the length of the shortest valid NTE event, whichever is less. Compliance with the 90% criteria will be determined by summing the duration of all the valid duration-limited NTE events that are less than or equal to the NTE Threshold and dividing by the sum of the duration of all the valid, duration-limited NTE events. If this ratio is greater than or equal to 90%, the vehicle shall be considered to have passed. Model year 2007 through 2009 vehicles must also meet the appropriate two times (2X) or

2.00 g/bhp-hr NTE event criteria. (See attachment for an example of this methodology.)

The NTE Threshold will be the NTE standard, including the margins built into the existing regulations, plus additional margin to account for in-use measurement accuracy. This additional margin shall be determined by the measurement processes and methodologies to be developed and approved by EPA/CARB/EMA. This margin will be structured to encourage instrument manufacturers to develop more and more accurate instruments in the future. To this end, EPA/CARB intends to adjust or phase-out such a margin through rulemaking based upon improvements to in-use NTE testing equipment. No such rulemaking shall go into effect prior to 2010. Nevertheless, at the time that the adjustment or phase-out is promulgated through rulemaking, it would apply to any subsequent testing under this program involving 2007 or later model year vehicles.

Family Evaluation Criteria

If 5 out of 5 or 5 out of 6 vehicles in the Phase 1 sample of test vehicles meet the vehicle pass criteria, then the manufacturer may terminate Phase 1 testing for the designated heavy-duty on-highway diesel engine family, and the manufacturer will not be required to take any further action or to submit any further data to EPA/CARB under the in-use NTE testing program for that engine family during that year's in-use testing.

If 2 out of 6 vehicles in the Phase 1 sample of test vehicles do not meet the vehicle pass criteria, but the additional 4 vehicles procured and tested under Phase 1 meet the vehicle pass criteria (i.e. 8 out of 10 vehicles), then the manufacturer may terminate Phase 1 testing for the designated heavy-duty on-highway diesel engine family, and the manufacturer will not be required to take any further action or to submit any further data to EPA/CARB under the in-use NTE testing program for that engine family during that year's in-use testing.

EPA/CARB reserves the right to test any engine family already tested in the manufacturer-run program. However, EPA/CARB will not engage in routine testing of such engine families for compliance with the NTE requirements beyond verifying the results of manufacturer testing, unless information indicates that such testing is appropriate. EPA/CARB will confirm its commitment not to do routine testing in the Preamble/Initial Statement of Reasons to any proposed rule implementing the in-use NTE testing program described herein.

Phase 1 Follow Up

At the conclusion of the required Phase 1 testing, one of three potential follow-up options will be undertaken:

- If no more than 2 vehicles from the Phase 1 sample of test vehicles have not passed the vehicle pass criteria, then the manufacturer will not be required to

undertake any additional testing, submit additional data or engage in further discussions with EPA/CARB with respect to the designated heavy-duty diesel engine family tested as part of that year's program.

- If 3 or 4 vehicles from the Phase 1 sample of test vehicles have not passed the vehicle pass criteria, then the manufacturer will engage in follow-up discussions with EPA/CARB to determine whether any further testing, data submissions or other actions may be warranted. Other actions, as described above, may include seeking some form of remedial action.

- If 5 or more vehicles from the Phase 1 sample of test vehicles have not passed the vehicle pass criteria, then the manufacturer will engage in follow-up discussions with EPA/CARB to determine what type of additional testing, investigation, data submissions or other actions may be warranted. Under those circumstances, EPA/CARB may mandate that the manufacturer undertake Phase 2 testing unless the manufacturer agrees with EPA/CARB that some form of remedial action is warranted. The manufacturer may under any circumstances elect to conduct Phase 2 testing.

Number of Engine Families

Each year, EPA/CARB may designate for testing up to 25% of a manufacturer's total number of heavy-duty on-highway diesel engine families, provided that engine families with annual US-directed production volume of 1500 engines or less shall not be included in the total number of engine families subject to the 25% calculation. For manufacturers that have no engine families with an annual US-directed production volume of 1500 engines or more, EPA/CARB may designate one engine family per year for testing. Not withstanding the forgoing, unless there is clear evidence of a nonconformity with respect to a specific diesel engine family, no engine manufacturer shall be required to test, over the course of any four-year period, a number of engine families that exceeds the manufacturer's total number of heavy-duty on-highway diesel engine families.

Small or Otherwise Unavailable Engine Families

In the event that a manufacturer cannot obtain, after diligent and good faith efforts to do so, access to a sufficient number of test vehicles from a designated diesel engine family to be able to complete the Phase 1 testing in the time frame or manner required, the manufacturer may request that EPA/CARB modify the Phase 1 testing requirements for such engine family or designate a different diesel engine family for Phase 1 testing.

PHASE 2 PROGRAM ELEMENTS

Initiation Mechanism

The Phase 2 testing program may be required by EPA/CARB in the event that 5 or more of the Phase 1 ten test vehicles from a designated heavy-duty on-highway

diesel engine family do not pass the Phase I vehicle pass criteria and the manufacturer does not agree with EPA/CARB that some form of remedial action is warranted. Also, if EPA/CARB and the engine manufacturer agree, the manufacturer may undertake Phase 2 testing if 3 or 4 of the Phase 1 test vehicles do not pass the Phase 1 vehicle pass criteria. Finally, the engine manufacturer may under any circumstances elect to undertake Phase 2 testing.

Sample Size

Upon the initiation of Phase 2 testing for a designated heavy-duty on-highway diesel engine family, the manufacturer may be required to test up to ten (10) additional vehicles using the same protocols as for Phase 1. EPA/CARB may require the testing of less than ten (10) vehicles and reserves the right to have the manufacturer test a sub-class of vehicles within the designated diesel engine family.

Manufacturer's Supplemental Data

In determining whether to pursue some form of remedial action following Phase 1 or Phase 2 testing, EPA/CARB will consider other data submitted by the engine manufacturer. Such data may be based on tests conducted using mobile onboard emissions testing devices, engine dynamometers, or chassis dynamometers. Such data may include, among other things: the margin by which any exceedence(s) were above the NTE Threshold; the number of engines that showed exceedences; the frequency and duration of any exceedences as compared with the aggregate amount of time that all of the test vehicles were operated within the NTE zone; the emissions of the test vehicles over the entire test route, including average(s); the projected emissions impact of the exceedences; and, the relationship of the exceedences at issue to the engine family's ability to comply with the applicable standards or FELs. EPA/CARB will also consider any other data or factors relevant to determining whether to pursue some form of remedial action.

OTHER ISSUES

Quantity of Data Collected

During 2005 and 2006, the minimum time for data collection from a test vehicle shall be one full shift day of operation, provided that each test vehicle shall operate in non-idle modes for at least 3 hours. Prior to the commencement of in-use testing, the manufacturer shall screen-out from Phase 1 testing any vehicles that the manufacturer reasonably determines are not likely to operate in non-idle modes for at least 3 hours over a full shift. In the event that a selected test vehicle does not operate in non-idle modes for at least 3 hours over the full shift day, the vehicle shall be tested over a second full shift day of operation. Testing shall not be required beyond the second full shift day even if that second day of testing also fails to yield in the aggregate 3 hours of vehicle operation in non-idle modes. In the event that no valid NTE sampling events are recorded from a selected test vehicle, that vehicle will be deemed to have satisfied the vehicle pass/fail criteria for the purposes of this in-use testing program. At their option, manufacturers

may conduct in-use testing of longer duration.

During 2005 and 2006, EPA, CARB, and EMA will undertake a statistical analysis of the available heavy-duty on-highway in-use testing data to determine the necessary parameters of the test regime. The end result could be either a longer or a shorter period of data collection, or other revisions to the in-use NTE testing program. EPA/CARB shall, if appropriate, amend the regulations based on the outcome of this analysis.

Measurement of Emissions

In-use NTE emissions testing will include total hydrocarbons (THC), carbon monoxide (CO), oxides of nitrogen (NO_x), particulate matter (PM), and carbon dioxide (CO_2) (and also O_2 as a component of test measurement specifications and as a means of assuring quality control), and shall be conducted through the use of test equipment capable of meeting all of the performance criteria to be determined and established by EPA/CARB and engine manufacturers (including the calculation of appropriate test margins to account for measurement accuracy), and capable of accurately sampling and calculating in a simultaneous manner each of the pollutants to be assessed. Recognizing that experience may show that the effectiveness, durability and overall performance of new engine technologies and aftertreatment systems may demonstrate that in-use testing for certain pollutants may not be necessary, EPA/CARB will consider requests from the engine manufacturers to discontinue reporting and/or measurement of one or more pollutants from some or all engines based on test experience.

Pilot Program

EPA/CARB believes that a pilot program in 2005 and 2006 will provide EPA, CARB, and engine manufacturers with the experience needed to ensure successful implementation of a fully enforceable in-use NTE testing program in 2007.

Under the pilot program, manufacturers will conduct in-use testing based on the Phase 1 criteria in 2005 and 2006 according to the scheme set forth above for the purposes of gaining experience with in-use testing protocols and for generating in-use emissions data. If the pilot program data derived on the basis of the Phase 1 criteria does not satisfy the Phase 1 testing criteria for a designated heavy-duty on-highway diesel engine family, EPA/CARB will not pursue any form of remedial action based on that data. However, EPA/CARB may utilize such data in conjunction with its own test data to assess or pursue any necessary and appropriate enforcement or some form of remedial actions that otherwise may be authorized during this pilot period.

Other Measurement Issues

Implementation of the manufacturer-run in-use testing program will be accomplished in a manner that allows for the test methodologies, procedures, equipment specifications and other technical issues (including, but not limited to the calculation of appropriate test margins to account for measurement accuracy)

that will be identified and specified by EPA/CARB and engine manufacturers to be fully incorporated into the in-use program.

Selective Enforcement Audits

EPA/CARB will limit the existing SEA program after full implementation of the manufacturer-run in-use program solely to instances where credible evidence indicates the existence of a nonconformity. Such evidence may include: manufacturer QA/QC reports that indicate problems, a significant number of consumer complaints or defect reports, or robust test data.

EPA/CARB Testing

EPA/CARB reserves the right to conduct repeat testing or conduct its own in-use testing. This testing is primarily intended to verify and supplement, not duplicate, the testing program to be conducted by manufacturers.

No routine NTE testing of engines or engine families that satisfy the Phase 1 testing criteria will be undertaken unless new information indicates that a nonconformity exists. EPA/CARB will inform and invite the manufacturers to oversee its in-use testing under this program.

Mileage and Screening of Test Vehicles

Test vehicles will be obtained from at least two sources and will be screened for proper use and maintenance. Manufacturers will also screen for vehicles that are reasonably likely to operate in non-idle modes for at least 3 hours over the course of a full shift day. In addition, vehicle engines that have been tampered with, rebuilt, or subjected to major repairs that could affect emissions, will not be used in testing. Test vehicles also will be "set to spec," and appropriate means will be established to ensure that test vehicles are operated only on diesel fuels meeting the requisite specifications under the applicable heavy-duty on-highway engine rule. Manufacturers may not screen-out test vehicles for high mileage except for those vehicles that exceed their regulatory useful life.

Test Conditions

For all Phase 1 testing, test vehicles are to be operated over normal driving routes, carrying their routine loads during normal atmospheric/environmental conditions using the normal owner/operator of the vehicle to do the driving. The intent is to record the emissions from heavy-duty on-highway test vehicles as they are used and operated on a normal day-to-day basis.

For Phase 2 testing, EPA/CARB will have the discretion to direct the manufacturer to conduct the Phase 2 testing of the test vehicles using a test route and driving conditions simulating the conditions observed in the Phase 1 testing that indicated a potential nonconformity. For Phase 2 testing, EPA/CARB also may specify the time period (of no less than 3 months in duration) during which the Phase 2 testing shall be performed, and may also specify the State and/or

contiguous States in which such Phase 2 testing shall be performed, provided that there is adequate lead time and vehicle availability to complete such specified Phase 2 testing.

Applicability

With the exception of the pilot program, this in-use testing program will cover 2007 and later model year on-highway heavy-duty diesel engines above 8,500 lbs. GVWR that are engine certified or not otherwise covered by the CAP 2000 program.

Reporting Requirements

Manufacturers will submit data/information from their in-use testing on a quarterly basis. Specifically, this submittal will be a comprehensive report using a standardized reporting format to be jointly developed by EPA/CARB and the engine manufacturers. The report will include all measured emissions test data, test conditions/parameters, and vehicle/engine/equipment information and specifications. The data from the testing of a designated heavy-duty on-highway diesel engine family will be completed and reported to EPA/CARB within eighteen months of the designation of that family by EPA/CARB.

DF Testing

In EPA's Preamble (and in CARB's Initial Statement of Reasons) to the rule, a discussion will be included explaining the flexibility manufacturers now have to generate deterioration factors (DFs) under current certification regulations. EPA/CARB will state in the Preamble/Initial Statement of Reasons that it will revisit the issue of deterioration factors in the rulemaking referenced above regarding the accuracy margin. Specifically, generation/submission of deterioration factors as well as other potential refinements/revisions to the in-use testing program will be assessed during the pilot program years (2005-2006). This will be accomplished by evaluating data collected either from the in-use testing program or any other in-use testing program using portable sampling systems. Through this process EPA/CARB will look at appropriate ways to diminish or eliminate the current burden on manufacturers of generating and submitting DFs, while still generating DFs that accurately predict in-use deterioration.

Limitation on Warranty Claims

The proposals for the in-use NTE testing program shall include the following provision establishing clear limits on the scope of manufacturers' potential statutory warranty liability for NTE exceedences that may occur in-use:

"An exceedence of the NTE found through the in-use testing program is not by itself sufficient to show a breach of the warranty under section 207(a)(1)(A) or (B). A breach of this warranty would also require either: 1) that, at the time of sale, the engine or vehicle was designed, built and equipped in a manner that does

not conform in all material respects reasonably related to emission controls to the engine as described in the application for certification and covered by the certificate, or 2) a defect in materials and workmanship of a component or part that causes the vehicle or engine to fail to conform to the applicable regulations for its useful life. To the extent that in-use NTE testing does not reveal such a material deficiency at the time of sale in the design or manufacture of an engine compared to the certified engine, or a defect in the materials and workmanship of a component or part, test results showing an exceedence of the NTE by itself would not show a breach of the warranty under section 207(a)(1)."

ATTACHMENT

Vehicle Pass (Fail) Criteria Example

For the example consider the likely following data set from a model year 2009 engine with 112,000 miles accumulated and a NOx FEL of 1.30 g/bhp-hp:

NTE Event	Duration (seconds)	Mean (g/bhp-hr)	Result (P/F)	Weighting Determination	Weighted Period (seconds)
1	45	4.80	F*	Lesser of 45, 450**,600	45
2	168	2.00	P	Lesser of 168,450, 600	168
3	605	1.80	P	Lesser of 605, 450, 600	450
4	490	1.90	P	Lesser of 490, 450, 600	450
5	65	4.75	F	Lesser of 65, 450, 600	65

* For this example the NTE Threshold is 2.50 g/bhp-hr
** 10 times the shortest valid NTE event.

The first NTE event is 45 seconds long. It is the shortest of the valid NTE events. Ten times 45 seconds equals 450 seconds. This becomes the second of the three comparisons in the weighting determination (the lesser of 1) the actual NTE event duration, 2) ten times the shortest valid NTE event, and 3) 600 seconds)).

$$\frac{\text{Sum of the Weighted Periods of the Passed NTE Events (seconds)}}{\text{Sum of the Weighted Periods of All NTE Events (seconds)}}$$

$$\frac{168+450+450}{45+168+450+450+65} = \frac{1068}{1178} = 0.91 \geq 0.90$$

Thus, the vehicle passes the 90% criteria because in this example the engine is a model year 2009 engine with an FEL of 1.3 g/bhp-hr and 112,000 miles accumulated, and all NTE events are below 5.00 g/bhp-hr (assuming a 15% measurement error margin). Therefore this engine passes the 2x NTE Threshold criteria.