United States
Environmental Protection
Agency

Air and Radiation

EPA420-R-00-011
July 2000

Control of Emissions of Air Pollution from 2004 and Later Model Year Heavy-Duty Highway Engines and Vehicles: Response to Comments

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Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

July, 2000

RESPONSE TO COMMENTS DOCUMENT

Control of Emissions of Air Pollution from 2004 and Later
Model Year Heavy-Duty Highway Engines and Vehicles

Table of Contents

CONTROL OF EMISSIONS OF AIR POLLUTION FROM 2004 AND LATER MODEL YEAR HEAVY-DUTY HIGHWAY ENGINES AND VEHICLES: RESP0NSE TO COMMENTS

INTRODUCTION

The EPA proposed this regulation on October 29, 1999, at 64 FR 58473. The proposal announced the opportunity for written public comment until December 2, 1999. The proposal also provided notice of a public hearings which was held on November 2, 1999 in Philadelphia, PA. On December 7, 1999, EPA reopened the comment period until December 16, 1999 for all issues in the proposal with the exception of the proposal to impose Tier 2 emission standards on passenger vehicles in the 8,501 - 10,000 pound GVWR range (64 FR 68310).

Complete transcripts of the public hearing and the full text of each comment letter may be found in Docket No. A-98-32. All data and information relied upon by EPA in developing the regulation also may be found in Docket No. A-98-32. This docket is available for public inspection and copying between 8:00 a.m. and 5:30 p.m., Monday through Friday, excluding government holidays, at Room M-1500, Waterside Mall, 401 M Street, S.W., Washington, D.C.

For Docket A-98-32, this document summarizes the written and oral comments submitted at the public hearing on November 2, 1999 (Docket Category IV-F), as well as the comment letters received during the public comment period (Docket Category IV-D), and records EPA's responses to those comments. In most cases in this document, EPA has listed all of the commenters who made a specific comment. In certain instances, however, the Agency may have identified one or a representative number of commenters. The reader should note that many of the most significant comments are also addressed in the preamble for the final rule and the responses in this document cross-reference the corresponding discussion in the preamble where appropriate.

The responses presented in this document are intended (1) to augment the responses to comments that appear in the preamble to the final rule, or (2) to address comments not discussed in the preamble to the final rule. Although portions of the preamble to the final rule may be paraphrased in this and other documents where useful to add clarity to responses, the preamble itself remains the definitive statement of the basic rationale for the final rule.

EPA received approximately 150 written comments. A copy of each comment letter received is included in the rulemaking docket. A list of commenters and the EPA docket item number assigned to their correspondence is also included in the docket. All of the comments have been carefully considered, and where determined to be appropriate, changes have been made in the final regulation.

The comments were divided in to 28 general issue areas. Comments within a particular Issue (or Subissue) are divided into specific comments (such as "Comment A" or Comment "A.1"), so that comments and responses on specific aspects of an Issue (Subissue) are grouped together. The lettering and numbering of these comments preserves the Agency's internal classification of points raised on a particular issue in the various comment letters. This approach allows for cross-referencing between responses to related comments. In certain places, comments have been consolidated in a logical manner for the Agency's response. Even in these consolidated comments, the comment identification in this document preserves the Agency's internal lettering and numbering identification system within an issue (for instance a comment may be identified as "Comments A, F, G, N, and S" if those individual comments have a single consolidated response.

ISSUE 1: GENERAL COMMENTS

Issue 1.1: Supports Proposal

COMMENT A: Generally supporting the key parameters of the proposal. Many commenters urged the Agency to withstand pressure from the engine manufacturing and oil industries to weaken the proposal. A number of commenters expressed general support for EPA efforts to reduce emissions from heavy-duty vehicles, but also included a number of suggestions on how the proposal could be strengthened. These specific suggestions (e.g., diesel fuel sulfur should be reduced) are generally addressed under the relevant issue headings elsewhere in this document. **(Sierra Club (IV-D-02), Massachusetts Department of Environmental Protection (IV-D-12), The League of Women Voters (IV-D-13), Georgia Department of Natural Resources (IV-D-14, IV-D-52), South Carolina Department of Health & Environmental Control (IV-D-16), Wisconsn Department of Transportation (IV-D-17), American Lung Association (IV-D-19), Wisconsin Dept. of Natural Resources (IV-D-20), NESCAUM (IV-D-26), STAPPA / ALAPCO (IV-D-32), Clean Air Network (IV-D-34), Illinois Environmental Protection Agency (IV-D-35), Manufacturers of Emission Controls Association (IV-D-38), New York State Department of Environmental Conservation (IV-D-41), State of Connecticut Department of Environmental Protection (IV-D-43), Broadlink Communications (IV-D-45), North Central Texas Council of Governments (IV-D-48), City of Los Angeles, California (IV-D-49), Coalition for Clean Air (IV-D-53), International Center for Technology Assessment (IV-D-61), Pennsylvania Department of Environmental Protection (IV-D-62), State of Missouri Department of Natural Resources (IV-D-63), Environmental & Energy Study Institute (IV-D-77), Ozone Transport Commission (IV-D-79), Automotive Service Association (IV-D-80), Multiple Private Citizens (IV-D-24, 25, 46, 47, 56, 58, 81-83, 85-87, 90-97, 99-110, 113-126, 128-140, 142-146, 148-149))**

RESPONSE: After consideration of all comments, we are finalizing a program for heavy-duty engines and vehicles that closely resembles the proposal. The major differences between the final rule and the proposal are with respect to the model years of implementation, which had to be altered for the final rule due to requirements in the Clean Air Act pertaining to lead time and due to concerns raised about stability for new standards (see Issue 4 later in this document).

COMMENT B: The proposal, when finalized, will provide much needed emission reductions in areas not meeting or maintaining federal health-based air quality standards, and will assist states and regions in achieving their air quality goals. **(Massachusetts Department of Environmental Protection (IV-D-12), Wisconsin Dept. of Natural Resources (IV-D-20), New York State Department of Environmental Conservation (IV-D-41), State of Connecticut Department of Environmental Protection (IV-D-43), Pennsylvania Department of Environmental Protection (IV-D-62), State of Missouri Department of Natural Resources (IV-D-63), Ozone Transport Commission (IV-D-79))**

RESPONSE: We agree with this view, as described in the preamble to the final rule, the Regulatory Impact Analysis for this final rule, and elsewhere in this Response to Comments Document (see Issue 2).

COMMENT C: Support for a nationwide program, rather than state or local controls. These commenters generally cite the interstate nature of truck travel as a factor that makes state or local

controls ineffective or undesirable. Some cite the potential for competitive disadvantages and/or socioeconomic impacts that could result from a patchwork of state or regional programs. **(Massachusetts Department of Environmental Protection (IV-D-12), Wisconsin Dept. of Natural Resources (IV-D-20), New York State Department of Environmental Conservation (IV-D-41), City of Los Angeles, California (IV-D-49), Ozone Transport Commission (IV-D-79))**

RESPONSE: We agree that a federal nationwide program, such as the one we are finalizing, will provide greater emission reductions in a more cost-effective manner than a patchwork of state programs. As we noted in the proposed rulemaking, one of the important considerations is the need for harmonized, 50-state emission standards for the heavy-duty industry. Consistent national standards provide the states with the emission reductions they need while providing manufacturers with the knowledge they can design and market one engine design regardless of what state the engine is delivered to. Consistent with this, the final rule implements nationwide standards which harmonize with California for the majority of heavy-duty engines and vehicles in 2004.

Issue 1.2: Opposes Proposal

Issue 1.2.1: Proposal Too Stringent

COMMENT A: The proposed diesel NTE standards are not, or may not be, feasible. **(Mack Trucks Inc. (IV-D-06), Detroit Diesel Corporation (IV-D-28), Navistar (IV-D-29), DaimlerChrysler (IV-D-44))** The "off-cycle" requirements for diesels substantially increase the stringency of the original proposal agreed upon in the 2004 heavy-duty emission standards finalized in 1997. **(Engine Manufacturers Association (IV-D-05), DaimlerChrysler (IV-D-44))** Compliance with the NTE when the engine is operated under all conditions which may reasonably be expected in normal operation and use represents an undue increase in stringency over the proposed limits. **(DaimlerChrysler (IV-D-44))** The proposed supplemental requirements will result in an unjustifiable increase in the stringency of emission control requirements and render the 2004 heavy-duty diesel engine standards infeasible. **(Engine Manufacturers Association (IV-D-05), Navistar (IV-D-29))**

RESPONSE: See Issue 8.

COMMENT B: The 1.0 g/bhp-hr NHMC+NOx standard for heavy-duty gasoline engines is too stringent and should not be finalized. Use of "worst-case" DFs further increases stringency unacceptably. EPA should finalize a 1.5 g/bhp-hr standard. **(Engine Manufacturers Association (IV-D-05), Ford Motor Company (IV-D-08), DaimlerChrysler (IV-D-44))** EPA should finalize a 1.5 g/bhp-hr standard. **(Ford Motor Company (IV-D-08), DaimlerChrysler (IV-D-44))** EPA should finalize a 2.0 g/bhp-hr standard. **(Engine Manufacturers Association (IV-D-05))**

RESPONSE: See Issue 14.

COMMENT C: The requirement to monitor diesel catalysts is infeasible and should be deleted. **(Engine Manufacturers Association (IV-D-05), Navistar (IV-D-29), DaimlerChrysler (IV-D-44), Volkswagen of America (IV-D-51))** Emission threshold monitoring of particulate traps is neither feasible nor necessary. **(Engine Manufacturers Association (IV-D-05), Ford Motor Company (IV-D-08), Navistar (IV-D-29), Volkswagen of America (IV-D-51))** Separate engine and vehicle phase-in requirements increase the stringency of the proposed OBD requirements. **(Engine**

Manufacturers Association (IV-D-05))

RESPONSE: See Issue 20.

COMMENT D: The 5% MAEL allowance is infeasible and inadequate, and should be in the range of 15-20%. **(Detroit Diesel Corporation (IV-D-28))**

RESPONSE: See Issue 8.

COMMENT E: The 4% smoke opacity limit is unnecessarily stringent and below visibility limits, and achieving this level over all ambient conditions and all operating conditions within the NTE zone may be impossible. **(Detroit Diesel Corporation (IV-D-28))**

RESPONSE: See Issue 8.

COMMENT F: Expanded ambient conditions increase stringency. **(Navistar (IV-D-29))**

RESPONSE: See Issue 8.

COMMENT G: Expanded definition of defeat device definition substantially increases stringency of supplemental requirements. **(Engine Manufacturers Association (IV-D-05), Navistar (IV-D-29))**

RESPONSE: See Issue 21.

COMMENT H: The failure of EPA to provide low sulfur fuel increases the stringency of the proposed standards. **(Engine Manufacturers Association (IV-D-05))**

RESPONSE: See Issue 11.

Issue 1.2.2: Proposal Too Lenient

COMMENT A: All passenger vehicles, including light trucks and SUVs, should meet the same standards at the same time. **(Multiple Private Citizens (IV-D-85, 86-87, 90-97, 99-107, 109-110, 113, 115-126, 128-140, 142-145, 148-149))** All SUVs and trucks should comply with cleaner Tier 2 standards by 2007, regardless of weight. **(Sierra Club (IV-D-02))**

RESPONSE: See Issue 26.

COMMENT B: The EPA should eliminate the special breaks for more-polluting diesel vehicles. **(Multiple Private Citizens (IV-D-85, 86-87, 90-97, 99-107, 109-110, 113, 115-126, 128-140, 142-145, 148-149))** The standards should be fuel-neutral. Vehicles performing the same functions need to meet the same standards regardless of whether they are gasoline or diesel powered. **(Puget Sound Clean Air Agency (IV-D-3))**

RESPONSE: These commenters are not specific regarding the “special breaks” that diesel engines are able to take advantage of, or whether the comment is in the context of light-duty or heavy-duty vehicles. In the heavy-duty arena it has historically been the case that diesel-fueled and gasoline-

fueled engines have been required to meet generally the same standards, with no “special breaks” available for diesel-fueled engines. Our proposed rule diverged from this historical approach for reasons explained in detail in the proposal and in the preamble to the final rule. In brief, we believe that, considering the fuels (i.e., fuel sulfur levels) and the technologies available in the 2004 time frame, heavy-duty gasoline-fueled vehicles are capable of meeting more stringent standards than heavy-duty diesel-fueled vehicles. We do not regard - and neither should the commenters - the fact that diesel-fueled engines will be meeting less stringent standards in the 2004 time frame as a special break; in fact, we regard the structure of the standards that we have finalized as a structure that applies standards of appropriate stringency to all heavy-duty engines, as is required under section 202(a)(3) of the Clean Air Act. Under section 202(a)(3) of the Clean Air Act, EPA must promulgate regulations that contain standards that “reflect the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology.” We believe that the finalized emission standards for heavy-duty diesel engines meet this requirement.

COMMENT C: The EPA must do more to get advanced technology vehicles on the road, including battery-electric and fuel-cell powered cars. **(Multiple Private Citizens (IV-D-85, 86-87, 90-97, 99-107, 109-110, 113, 115-126, 128-140, 142-145, 148-149))**

RESPONSE: We agree with these commenters that the goal of advancing emission control technology is an important one. However, the portion of the comment that pertains to cars (i.e., light-duty vehicles) is not relevant to the proposal. Our final rule addresses the advancement of technology in a manner that is consistent with the requirements of section 202(a)(3)(A) of the Clean Air Act and in the context of currently available technologies and fuels. (Section 202(a)(3)(A) require standards “which reflect the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology.”)

ISSUE 2: AIR QUALITY AND HEALTH EFFECTS

Issue 2.1 General

Note: On December 2, 1999, General Motors Corporation (GM) submitted comments focused on the proposed change in the regulatory definition of light-duty trucks. EPA addressed comments specific to this issue as a part of the Tier 2/Gasoline Sulfur final rule, since we promulgated the definition change in that rule. GM also included in these December 2 comments several comments -- related to air quality issues -- that apply generally to all heavy-duty gasoline engine regulations, including those we are finalizing in this rule. Thus, although these latter comments were submitted in the context of the LDT definition change, we have interpreted these comments broadly and address them as a part of this rule.

COMMENT A: General Motors Corporation (GM) and Isuzu Motors America, Inc., in joint comments, state that the proposed program is "invalid because it is not needed to satisfy the NAAQS." GM and Isuzu make the following points to support this contention:

EPA may revise emission standards under Section 202 only to the extent necessary to satisfy the NAAQS.

- The criteria for promulgating emissions standards under Section 202 are co-extensive with the criteria for setting NAAQS under Section 109.
- Any other reading of Section 202(a) would be inconsistent with the statute as a whole and with the history of the statute.
- It would be improper to use emission standards and NAAQS to pursue different levels of public health at the same time.
- The "need" requirement is especially strong for the new vehicle standards related to the ozone NAAQS.
- Lead fuel additive standards are distinguishable.
- Promulgating emission standards that are not needed to meet the NAAQS would thwart Congress' intent.

The commenters also state that EPA's proposed emissions standards are not needed to satisfy the ozone and PM NAAQS.

- EPA may not rely on the invalidated 8-hour ozone NAAQS.
- EPA's proposed emission standards are not needed to satisfy the 1-Hour ozone NAAQS.
- EPA's proposed emissions standards are not needed to satisfy the PM NAAQS.
- EPA cannot base the required showing of need on air toxics. The commenters stated that there was a recent vote of the Clean Air Science Advisory Committee to remand a draft EPA report that characterized diesel PM emissions as "highly likely to be carcinogenic."

The commenters also refer to and attach the comments that GM recently submitted in response to our proposed Tier 2/Gasoline Sulfur program. They state that those comments, which supported GM's position that the Tier 2 program was not needed, also apply to this rule. **(General Motors Corporation and Isuzu Motors America, Inc. (IV-D-65))**

RESPONSE: The commenters claim that standards promulgated under section 202(a) are restricted to what is needed to attain and maintain a NAAQS. Yet nothing in section 202(a) so restricts it. Section 202(a) permits EPA to promulgate standards "applicable to the emission of any

air pollutant from any class or classes of new motor vehicles or ... engines, which in his judgment cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare." On its face, this provision does not tie such standards to the attainment and maintenance of a NAAQS. Indeed, there are numerous types of air pollution regulated under the Act that are not covered by the section 109 NAAQSs. For example, EPA has authority under section 112 to regulate 189 "hazardous air pollutants," ("HAPs") and may add to the list of HAPs any "pollutants which present, or may present,...a threat of adverse human health effects ... or adverse environmental effects." The Clean Air Act also regulates visibility (section 169A and 169B), acid rain (Title IV) and depletion of stratospheric ozone (Title VI). All of these air pollution concerns can, by any measure, be "reasonably anticipated to endanger public health or welfare."

Further, it is clear from the language of the statute that section 202(a) was not intended to be restricted to meeting the NAAQSs. As commenters note, section 202(i) specifically references attainment and maintenance of the NAAQS as a criterion for regulations. What this evidences, however, is that Congress was well aware of its ability to confine EPA's review to NAAQS attainment, and has so confined EPA when it wished to. However, unlike section 202(i), section 202(a) has no such restriction.

Similarly, as the commenter notes, section 202(a) was enacted in 1965, prior to section 109 being added to the Act. It therefore had to be a source of authority independent from section 109 for determining the appropriateness of promulgating motor vehicle standards. When Congress added sections 108 and 109 in 1970, Congress could have revised section 202(a) to restrict its review to meeting and maintaining NAAQSs, but Congress did not so revise section 202(a), preserving the independent authority provided in 1965.

Section 202(l) also makes clear that section 202(a) is not restricted to NAAQSs. Under section 202(l), EPA is required to promulgate standards under subsection (a), containing reasonable requirements to control hazardous air pollutants from motor vehicles and fuels. If section 202(a) were restricted to NAAQS-related standards, then EPA could not promulgate standards "under section 202(a)" regulating hazardous air pollutants, which are not NAAQS related pollutants.

The commenters note that the language in section 109 (actually sections 108 and 109) is similar to that in section 202(a). But that is also true, to some extent, with regard to other portions of the Act under which we regulate other pollutants. See section 112. The courts have held that EPA may regulate non-NAAQS pollutants in promulgating standards controlling emissions that "may reasonably be anticipated to endanger public health or welfare." See Engine Manufacturers Assn. v. EPA, 88 F.3d 1075, 1099 (D.C. Cir. 1996).

EPA believes that consideration of air quality need under section 202(a) is not limited to consideration of pollutants for which a NAAQS has been established. In this rulemaking EPA did consider air quality need under section 202(a) with respect to emissions that are related to a pollutant for which a NAAQS has been set. This was the primary focus of EPA's consideration of air quality; however, EPA also took into account the impact of these emissions on air quality problems for which no NAAQS has been set, such as air toxics.

The commenters also state that the air quality test for promulgating a standard under section 109 is as stringent or more stringent than the test under section 202(a), so the air quality need criteria under section 202(a) should not be more stringent than that under section 109. Where EPA did

focus on NAAQS related emissions, its consideration of air quality for purposes of need for reductions was limited to consideration of need for further reductions to attain and maintain the 1-hour ozone NAAQS and the preexisting PM10 NAAQS. EPA did not in this rulemaking use its section 202(a) authority to achieve emissions reductions aimed at achieving air quality levels more protective than the NAAQS. As such, the commenters objections are moot. In any case, EPA does not agree that the language of section 109 and the level of air quality control established under that section binds it in acting under section 202(a). Section 202(a) does not refer to sections 108 or 109 and contains different language than those sections, in particular, the standard-setting section 109. The judicial precedent and legislative history of this section clearly show that EPA is not limited by sections 108 and 109 in promulgating its rules under section 202(a). See Ethyl Corp. v EPA, 541 F.2d 1 (D.C. Cir. 1976); Small Refiner Lead Phasedown Task Force v. EPA, 705 F.2d 506 (D.C. Cir. 1983); HR Rep. 95-294, Committee on Interstate and Foreign Commerce, May 12, 1977, at 43-51. The commenters' attempts to distinguish these cases is not convincing. However, as noted above, that is not relevant to this rulemaking, as EPA did not attempt to achieve emission reductions below the levels of the NAAQS.

It is also clear from the legislative history of the 1990 Amendments that section 202(a)(3)(A), far from being merely applicable to the then-existing standards, was intended to be the primary vehicle for promulgating standards for heavy duty vehicles and engines in the future. See Statement of Senate Managers, Legislative History, at 886-887 ("The House amendment [for heavy-duty trucks]... authorizes the Administrator of EPA to set technology-forcing emission standards, considering cost, energy, and safety factors....The conference agreement adopts the House provisions."); H.R. 101-490, U.S. House of Representatives, Committee on Energy and Commerce, at 309, Leg. Hist. at 3333 (The House amendment "requires the Administrator to set technology-forcing emission standards, considering cost, energy and safety factors. ... It is the intent of the Committee that current standards for heavy-duty vehicles and engines remain in effect, until such standards are superceded by more stringent standards promulgated under the new provisions.")

In fact, section 202(a)(3)(B) is given barely any notice in the legislative history, despite the fact that it was part of the amendments for a significant time prior to passage. This subsection merely ensures that the Agency would not be forced to promulgate technology forcing standards under section 202(a)(3)(A) past the time that such standards were appropriate, based on air quality information. As indicated elsewhere in this rule, there is clear evidence that there will be air quality benefits from the standards promulgated in this rule for heavy-duty vehicles. Therefore, it is appropriate for EPA to promulgate these standards under section 202(a)(3)(A).

As described in the RIA and preamble for this rule, we believe that the 2004 program for HD diesels reviewed today and the new standards for HD gasoline engines established today are fully justifiable based on the current 1-hour ozone and PM_{10} NAAQS. Our revised air quality modeling, as described in the Tier 2/Gasoline Sulfur final rule and in the RIA and preamble for this rule, shows that there will still be a substantial need for further reductions in NOX, VOC, and PM from mobile sources in the coming decades in order to attain and maintain the 1-hour ozone and current PM_{10} NAAQS. We have only based our promulgation of the new standards on these pre-existing NAAQSs, not on the revised ozone and PM standards that were the subject of the recent the court decisions.

EPA is not restricted from evaluating air toxics concerns in promulgating standards under section 202(a). In fact, section 202(l) specifically cross-references section 202(a). However, commenters

are correct that the primary justification for these regulations is compliance with the ozone and PM NAAQS. We are addressing the issues raised by air toxics from motor vehicles and fuels in a separate rulemaking as well as in the recently proposed rule to control emissions from heavy-duty engines starting in model year 2007 (65 FR 35430, June 2 2000).

GM and Isuzu incorporate by reference large portions of GM's extensive specific comments about EPA's emission inventory and air quality modeling for the recent Tier 2/Gasoline Sulfur program. Our responses to the original comments are still valid and remain our position on each of these points. In general, we believe our modeling and our analysis of the modeling is reasoned and justified and does not contain the significant errors associated with the materials submitted by the commenters, and our conclusions about the need for additional emission controls after the Tier 2/Gasoline Sulfur program is implemented remain valid. (See the Response to Comments document for the Tier 2/Gasoline Sulfur final rule, which we have included in the docket for this rule (Docket Number A-98-32). In particular, see our response to Issues 27, 39 and 2.1.)

COMMENT B: Several commenters believe that air pollution remains a problem in the United States. They believe that control of emission from heavy-duty engines through a national rule is necessary and/or appropriate, and they support EPA's proposed action. They mention health and welfare concerns including asthma, soot, bronchitis, pneumonia, cardiopulmonary disease, acid deposition, haze, chest pain, coughing, shortness of breath, and premature death. **(Sierra Club (IV-D-02), Massachusetts Department of Environmental Protection (IV-D-12), The League of Women Voters (IV-D-13), South Carolina Department of Health & Environmental Control (IV-D-16), American Lung Association (IV-D-19), Wisconsin Dept. of Natural Resources (IV-D-20), NESCAUM (IV-D-26), STAPPA / ALAPCO (IV-D-32), Clean Air Network (IV-D-34), New York State Department of Environmental Conservation (IV-D-41), State of Connecticut Department of Environmental Protection (IV-D-43), Broadlink Communications (IV-D-45), North Central Texas Council of Governments (IV-D-48), City of Los Angeles, California (IV-D-49), Coalition for Clean Air (IV-D-53), Pennsylvania Department of Environmental Protection (IV-D-62), Ozone Transport Commission (IV-D-79), Multiple Private Citizens)** Some of these commenters urged EPA to establish tighter standards and/or a faster time line for the standards to become effective.

RESPONSE: We acknowledge and agree with the commenters about the need for this program. We discuss the need for the program in the preamble and Regulatory Impact Analysis for this rule as well as earlier in this section of this document (see Response to Comment A above). As we discuss in the preamble and elsewhere in this document, we do not believe it is appropriate to make these regulations applicable to earlier model year engines. Also, we believe that lower standards are not feasible or appropriate in the 2004-2005 time frame, but we are actively considering proposed regulations that would reduce emissions from these engines beginning in the 2007 time frame.

Issue 2.2 Particulate Matter

COMMENT A: The New York Department of Environmental Conservation requests that EPA evaluate whether PM mass standards alone are sufficient, in light of findings by the commenter that high counts of ultra-fine particles may exist in dilute exhaust from gasoline and diesel engines. They state that recent carcinogenicity and toxicology work indicates that ultra-fine particles (under about 50 nanometers in size) may be the most irritating in terms of human pulmonary response.

They urge EPA to require manufacturers to collect data on ultra-fine particulate emissions in order to inform a decision about whether mass-based standards are sufficient. **(New York State Department of Environmental Conservation (IV-D-41))**

RESPONSE: Evaluations of the PM national ambient air quality standards -- both for PM-10 and more recently for PM-2.5 -- have continued to point to reducing the mass of PM in ambient air as the key way to reduce harmful health effects of PM. Clearly, there are complex issues related to the measurement of the size and number of particles emitted by diesel engines.[1] We are actively working to resolve these issues and are following the work of others in this field -- including engine manufacturers, independent laboratories, universities, state and federal agencies (including New York State), and international organizations -- who are investigating the difficult issues related to appropriate test methods and test conditions for accurate measurement of PM number counts and size distributions. However, we are not aware that this or any other work to date supports a conclusion that other characteristics of diesel PM -- beyond mass of PM below a specific size -- need to be a part of PM testing or regulation.

Thus, the supplemental standards in this rule as they relate to PM (the HDDE NTE and SSS requirements), continue to focus on PM mass standards. As new information emerges, we will take it into consideration in setting future mobile source PM standards.

COMMENT B: The Engine Manufacturers Association presents summaries of epidemiological and other information to support their position that available data do not prove that "exposure to diesel particulate results in increased risk of lung cancer." **(Engine Manufacturers Association (IV-D-05))**

RESPONSE: As discussed above, EPA based its air quality showing primarily on the need to meet the ozone and PM NAAQS. Although we noted our potential concern regarding the possible carcinogenic and mutagenic effects of diesel particulate exhaust, we made clear that these issues would be addressed in other EPA actions, not this rulemaking. We are not proposing any reduction in the primary standards for particulate in this rule, though our supplemental requirements do include new measures to ensure PM emissions are approximately at the level of the primary standard in-use. The comment is therefore not applicable to this rule.

Issue 2.3 Potential Increases in Ozone with NOx Reductions

COMMENT A: The standards may not be appropriate or necessary to meet the NAAQS due to the potential for ozone increases with NOx reductions in some areas. EPA should further analyze this issue before finalizing the rule and further reducing NOx emissions from mobile sources. **(U.S. Representative D. McIntosh (IV-D-54))**

RESPONSE: This issue of NOx reductions potentially increasing ozone levels in certain cases has been studied for over a decade. This issue had been raised in the late 1980s and was

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[1] For recent discussions of some of the complex diesel PM size distribution measurement issues see Society of Automotive Engineers paper numbers: no. 1999-01-1142, "Influence of Dilution Conditions on Diesel Exhaust Particle Size Distribution Measurements"; no. 2000-01-0515, "Nanoparticle Growth during Dilution and Cooling of Diesel Exhaust: Experimental Investigation and Theoretical Assessment"; and no. 2000-01-2212, "Diesel Aerosol Sampling in the Atmosphere"

acknowledged and considered by a panel of the National Academy of Sciences in their report titled "Rethinking the Ozone Problem in Urban and Regional Air Pollution" (National Research Council, 1991). Since then, we have consistently followed the recommendations presented in the report. They concluded that for the nation to reach attainment of the ozone NAAQS, large, regional scale reductions of NOx would be needed, despite the potential for localized ozone increases in some cases. Since then, EPA has adopted or proposed a set of programs that are consistent with the NAS recommendations. These programs, when combined with a number of state and local activities, continue emphasize NOx reductions.

In the recently finalized Tier 2/Gasoline Sulfur rule, we presented a detailed response to this and a range of related issues (see Section 27.1.H of the Response to Comments document for the Tier 2/Gasoline Sulfur rule, which we have included in the docket for this rule (Docket Number A-98-32). In that rule, we explicitly considered both the evidence for and analyses of any potential localized elevations in ozone that might occur as a result of that rule. Also in that rule, we incorporated the expected NOx emission reductions from the 2004 HD diesel standards reviewed in this rule. We carefully studied information provided by commenters, including the data provided by Congressman McIntosh for this rule, as well as our own analyses of this issue. We concluded that improvements in ozone levels are expected to occur throughout the country because of the Tier 2/Gasoline Sulfur (Tier 2) program (and all previous programs). In the vast majority of areas, the air quality modeling predicted that the program will lower peak summer ozone concentrations for both 2007 and 2030.

The Response to Comments document for the Tier 2/Gasoline Sulfur final rule (referenced above) also notes that, in addition to these broad ozone reductions, a few metropolitan areas had predicted ozone increases in portions of the area during parts of the episodes modeled. In most of these areas, the sum of the reductions exceed the sum of the increases, allowing EPA to conclude that there will be a net reduction in ozone levels in these areas due to Tier 2 and previous programs (including the heavy-duty diesel NOx reductions from the 2004 rule). In the very small number of exceptions, the Agency did find benefit in the form of reductions of peak ozone levels. We concluded for Tier 2 that the large NOx reductions from that program would produce ozone improvements that would outweigh the limited ozone increases that may occur.

We believe that this conclusion applies to the NOx reductions of the heavy-duty gasoline portion of this rule as well. These smaller NOx reductions were not included in the Tier 2/Gasoline Sulfur analyses, but we believe that they will have an effect similar to earlier mobile source NOx reductions -- that is, that the broad NOx reductions across the country will result in broad reductions in ozone, with ozone reductions generally outweighing occasional occurrences of ozone increases. Therefore, we believe that the 2004 HD program for diesel and gasoline vehicles will not result in any the general ozone increases such as those suggested by Congressman McIntosh. We also note that, as for the Tier 2 program, no state responsible for achieving attainment of the ozone NAAQS has commented that this program will make achieving attainment harder, and many have strongly encouraged EPA to implement the proposed program (or a more stringent program).

ISSUE 3: EMISSIONS INVENTORY AND BENEFITS MODELING

Issue 3.1 PM in Urban Areas

COMMENT A: One commenter expressed concern that we underestimated the need for particulate control in our modeling. They suggested that we revise the current particulate model to accurately consider the conditions in urban areas such as New York City where PM control is necessary. **(New York State Department of Environmental Conservation (IV-D-41))**

RESPONSE: We recognize that PM emissions can be much larger in urban areas than in rural areas. When we perform nationwide air quality analyses, we calculate county level results. However, for the purpose of this rulemaking, we rely on national figures. Although we do not focus on PM reductions in this rule, we do anticipate some reduction of indirect nitrate PM because of the large NOx reductions. In addition, we have recently proposed stringent PM standards for 2007 in another rulemaking which would require a 90% reduction in PM from new engines.

Issue 3.2 Deterioration Factors for Heavy-duty Diesel Engines

COMMENT B: We received comment that we did not accurately reflect HDDE emissions in our inventory projections because we did not fully account for deterioration, tampering, or malmaintenance. For instance, EGR deterioration or malfunction would likely go unnoticed by the driver. Also, our baseline projections need to include the effects of excess emissions from HDDEs that emit much higher NOx in-use than over the certification test procedure. **(NESCAUM (IV-D-26), STAPPA/ALAPCO (IV-D-32))**

RESPONSE: We agree that it would improve our PM inventory if we could fully account for deterioration, tampering, and malmaintenance. Because this rule is not focused on PM reduction, we will not make an attempt to quantify these factors here. However, we intend to investigate the in-use effects of emissions control on HDDEs and quantify these effects in future analyses. We added the excess NOx emissions to the inventory for the final rule.

COMMENT C: One commenter stated that emission inventories for HDGVs need to be calculated using MM5B2 model or a later model that have appropriate deterioration and OBD credits and that the growth rates should be identified. In addition, they commented that the increase in emissions projected for the middle of next decade in the preamble is inconsistent with the projections in the RIA. **(General Motors/Isuzu (IV-D-65))**

RESPONSE: The inventory analysis in the FRM uses emission and deterioration factors that have been developed for use in MOBILE6. This includes the updates in the MM5B2 model, and we consider these to be the most current and representative numbers. The FRM also uses the most recent growth projections for vehicle miles traveled. Recently, we decided to use more conservative linear growth rates rather than exponential growth rates. These emission and deterioration factors and growth rates are discussed in the RIA. OBD benefits are also discussed in the RIA.

ISSUE 4: LEAD TIME AND STABILITY ISSUES

Section 203(a)(3)(C) of the Clean Air Act requires the following:

> "LEAD TIME AND STABILITY -- Any standard promulgated or revised under this paragraph and applicable to classes or categories of heavy-duty vehicles or engines shall apply for a period of no less than 3 model years beginning no earlier than the model yea commencing 4 years after such revised standard is promulgated."

COMMENT A: Some commenters reiterated the requirements in section 203(a)(3)(C) of the Clean Air Act. Commenters state that the timing of the rulemaking precludes EPA from implementing the proposed new standards earlier than the 2005 model year (some stated that this would be true in some cases even if EPA met a December 31, 1999 deadline for a final rule). EPA must provide manufacturers with the statutorily mandated minimum four years of lead time. **(Engine Manufacturers Association (IV-D-05), Alliance of Automobile Manufacturers (IV-D-07), Ford Motor Company (IV-D-08), DaimlerChrysler (IV-D-22), General Motors Corporation (IV-D-65))** EPA may also not modify the 2004 heavy-duty diesel standards, including by the addition of the new supplemental standards, until the 2007 model year at the earliest. **(Sunoco (IV-D-11), Navistar (IV-D-29))** Any standards that take effect starting with the 2005 model year must remain in effect for the three model years. **(General Motors Corporation (IV-D-65))** These statutory lead time and stability requirements are essential to the development of cost-effective emission control systems designed to achieve air quality improvements without compromising other important heavy-duty vehicle attributes. EPA may be acting contrary to the Clean Air Act. **(National Automobile Dealers Association (IV-D-31))** By failing to provide adequate lead time EPA has exceeded its authority under the Clean Air Act. **(Engine Manufacturers Association (IV-D-05))**

RESPONSE: We are fully aware of the implications and understand the importance of the statutory requirements noted above, and have finalized a program that is consistent with these requirements of the Clean Air Act. As explained in detail in the preamble to this final rule, concerns regarding the lead time and stability provisions in the statute necessitate implementation of the heavy-duty gasoline vehicle and engine provisions no earlier than the 2005 model year. In fact, depending upon the date a model year starts, some 2005 model year engine families/test groups may be exempt from the new requirements. We have included two voluntary options for Otto-cycle vehicles and engines that enable manufacturers to meet new standards earlier than we would otherwise be allowed under the leadtime provisions of the Clean Air Act. These "early-introduction" options are purely voluntary; manufacturers may take advantage of one of these options or they may choose the option that provides for the full amount of leadtime required under the statute. As noted by some of the commenters, this four year lead time requirement does not apply to the diesel standards finalized in 1997. Regarding the new supplemental provisions for diesel engines, we are not convinced that the stability provision of section 203(a)(3)(C) requires that EPA not impose these requirements until 2007. The supplemental requirements do not modify the preexisting NOx standard, but add new standards. However, we believe that, given the close connection between the supplemental standards and the preexisting standard, and the uncertainty regarding their status, it is appropriate to provide three years of stability between the implementation of the 2004 NOx standard and the supplemental standards. Any potential lead time or stability issues in the proposal have been cured in this final rule by adopting the supplemental standards effective for model year 2007.

COMMENT B: The lead time and stability requirements in the Clean Air Act necessitate that EPA create as stringent a program as possible. **(Commonwealth of Massachusetts Department of Environmental Protection (IV-D-12))** EPA should not give the vehicle industries additional time beyond what was proposed. **(Pennsylvania Chapter of the Sierra Club (IV-D-15))** The proposed

timeline is too long. The final rule should reduce the allowable PM emissions by 50 percent by 2004, or EPA should reduce both NOx and PM by at least 90% by no later than 2007. **(International Center for Technology Assessment (IV-D-61))**

RESPONSE: After consideration of all of the comments we have finalized a program that we believe is consistent with the statutory requirements regarding lead time, as well as with the requirements in section 202(a)(3)(A) that require standards "which reflect the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology." Contrary to some commenters' suggestions we can not implement new standards earlier than the 2005 model year.

ISSUE 5: VOLUNTARY NATIONAL STANDARDS

We requested comment in the proposed rulemaking on the possibility of implementing a voluntary program that would start with the 2004 model year in the event that the timing of the final rule precluded mandatory implementation in the 2004 model year.

COMMENT A: Commenters encouraged EPA to work with manufacturers to develop a voluntary compliance program that would start in the 2004 model year in the event that a mandatory program is not possible. **(Commonwealth of Massachusetts Department of Environmental Protection (IV-D-12), Wisconsin Department of Transportation (IV-D-17), State of Missouri Department of Natural Resources (IV-D-63))**

RESPONSE: Where appropriate, we have finalized provisions that enable manufacturers to produce cleaner vehicles and engines prior to when the mandatory regulations take effect. These options, generally applicable to heavy-duty gasoline vehicles and engines, are explained in detail in the preamble to the final rule. As a result of these optional programs, which we expect manufacturers to take advantage of, cleaner heavy-duty gasoline vehicles and engines will be introduced as early as the 2003 model year.

While we considered and attempted to craft a voluntary program for heavy-duty diesel engines prior to implementation of the supplemental requirements in the 2007 model year, we determined that such a program was not necessary and would have limited interest. In the time frame from 2004 through 2006, the Agency has existing regulatory authority, policy guidelines, and legal agreements which we are confident will ensure the majority of the environmental benefits of the supplemental test procedures will be met. This includes the existing CAA prohibition on the use of defeat devices, our existing guidance policy on the use of AECDs and defeat devices, and the 1998 HD consent decrees signed by a number of diesel engine manufacturers. With these policies and agreements in place, the Agency does not believe it is necessary to establish a voluntary program that would implement the supplemental test procedures for the time frame prior to 2007. The preamble to the final rule contains a detailed discussion of the tools available to the Agency to ensure that the anticipated environmental benefits of the supplemental test procedures will occur prior to model year 2007.

ISSUE 6: COST AND COST-EFFECTIVENESS OF PROPOSAL

COMMENT A: EMA stated that our cost analysis was inadequate, but provided no specific comments on the analysis. GM stated that cost-effectiveness for their vehicles (and those of other "companies that are not subject to the consent decrees") would be 20 times higher than we estimate. However, they did not provide supporting rationale for this argument other than to state that they would need to develop environmentally-controlled test chambers to comply with the supplemental test requirements, as well as diesel chassis-dynamometer facilities with increased weight rating capability, and to argue that we have overstated the emission reductions that this rule will achieve by including benefits that would result from the consent decrees and the SOP. DaimlerChrysler also stated that the supplemental test requirements will require additional test facilities. They also argued that these requirements would result in a fuel consumption penalty. ATA expressed concern that the supplemental test requirements will increase the cost of new engines, and stated that EPA must address this issue for the final rule. NESCAUM supported our cost-effectiveness analysis and stated that the measures in this rule were among the most effective control measures available for NOx. The Massachusetts Department of Environmental Protection stated that the heavy duty program is flexible and cost-effective. The Pennsylvania Department of Environmental Protection stated that it was appropriate to tighten heavy-duty diesel standards because technology was available that would control emissions cost effectively. **(EMA (IV-D-05), Mass DEP (IV-D-12), ATA (IV-D-21), NESCAUM (IV-D-26), DaimlerChrysler (IV-D-44), Penn DEP (IV-D-62), GM (IV-D-65))**

RESPONSE: We continue to believe that our analysis of the cost of this rule is accurate. We do agree that some additional testing will be necessary to comply with the supplemental standards, but do not agree that it will be so extensive that it will require manufacturers to construct new test facilities. As is described under Issue 8, we are finalizing the regulations in such a manner that manufacturers will be able to rely significantly on engineering analysis in addition to testing. Thus, the amount of testing required should be feasible with existing facilities. No components of this final rule require the development of diesel chassis-dynamometer facilities. We agree that this additional testing (and the associated engineering and overhead) will add to the cost of new engines, but it will only be a few dollars per engine. (See Chapter 4 of the RIA for additional information about costs.) This will be the only impact on costs since the supplemental test requirements will not require any new hardware. Therefore, the supplemental requirements will not substantially increase the cost of a new engine.

As is described in the RIA, we do not believe compliance with the 2004, 2005, and 2007 standards will result in a fuel consumption penalty relative to an engine that fully complies with the currently effective 4.0 g/bhp-hr NOx standard. Nevertheless, we have included a sensitivity analysis in the RIA showing the potential effect of increased fuel consumption on the cost-effectiveness of our new standards.

We disagree with the comments from GM that we have overestimated the benefits of 2004 standards because of the HD consent decrees and the SOP. We are reanalyzing the cost-effectiveness of the 2004 standards that were finalized in 1997, prior to the existence of the consent decrees. The consent decrees were developed based partially on the existence of the 2004 standards. It would not be appropriate for us to now deduct benefits from the analysis because they are now also associated with the consent decrees. More importantly, the HD consent decrees are not regulations and apply to only part of the HDDE industry, and may only apply for a

period of approximately two model years. Even if we used GM's recommended approach, we would at most deduct benefits for the 2004 model year. However, we would also need to deduct nearly all of the R&D and other fixed costs, which represent about one-half of the total costs for this rulemaking. Thus, the overall cost-effectiveness of the standards would be even better than what is indicated by our analysis. With respect to the SOP, GM incorrectly implies that the SOP would have controlled emissions if we had not reaffirmed the diesel standards or set new Otto-cycle standards. The SOP was not a regulation, and the SOP did not establish any emission standards (See also the response to Issue 8.2 in this document). Nevertheless, just as was true with respect to the consent decrees, GM's approach would have more impact on costs than on benefits, and would thus only improve the projected cost-effectiveness.

As is described in Section 3 and in the RIA, we have estimated environmental and economic impacts using the best available information. Our projections of emissions reductions and costs are reasonable and do not negatively impact our estimates of cost-effectiveness. The comments of NESCAUM, and the Massachusetts and Pennsylvania Departments of Environmental Protection indicate their agreement with this conclusion.

ISSUE 7: 2004 HEAVY-DUTY DIESEL FTP STANDARDS

Issue 7.1 Heavy-duty Diesel 2004 NMHC+NOx Standard

COMMENT A: Several organizations expressed general support for EPA's conclusion that the 2004 NMHC+NOx standards finalized in the 1997 rule are feasible. Some of the commenters stated that the 2004 NMHC+NOx standard should not be relaxed, and did not specifically say they supported the feasibility assessment (ALA). One commenter went on to state that the 2004 NMHC+NOx standards were both appropriate and were a cost effective means of controlling NOx emissions (NESCAUM). One commenter cites a number of technologies which they believe will enable manufacturers to meet the 2004 NMHC+NOx standards, including advanced fuel injection systems, cooled EGR, advanced turbocharging systems, and electronic controls (STAPPA/ALAPCO). One commenter agreed with EPA that the 2004 standards are achievable without changes to diesel fuel (Sunoco). Another commenter noted that the 2004 standards as contemplated in the Statement of Principles are within the technological reach of engine manufacturers in the 2004 time frame (EMA). **(Massachusetts Department of Environmental Protection (IV-D-12), American Lung Association (IV-D-19), Northeast States for Coordinated Air Use Management (IV-D-26), National Automobile Dealers Association (IV-D-31), STAPPA/ALAPCO (IV-D-32), Clean Air Network (IV-D-34), Manufacturers of Emission Controls Association (IV-D-38), Ozone Transport Commission (IV-D-79), Coalition for Clean Air (IV-D-53), Sunoco (IV-D-11), Engine Manufacturers Association (IV-D-5), Pennsylvanica Department of Environmental Protection (IV-D-62))**

RESPONSE: We agree with these comments. In the NPRM, we proposed that the 2004 NMHC+NOx standard for HD diesel engines which were finalized in 1997 are the appropriate standards for 2004. This final rule contains EPA's determination that the 2004 NMHC+NOx standard are appropriate under the CAA, considering the information we presented and our assessment of the comments received. The preamble and RIA for the NPRM, as well as the RIA for this final rule, contain a detailed discussion of emission control technology which EPA believes will be available by 2004 in order to meet the NMHC+NOx standards.

COMMENT B: One engine manufacturer, Detroit Diesel Corporation (DDC), stated that EPA's technological feasibility arguments tend to support the the conclusion that the 2004 NMHC+NOx standards will be feasible in that time frame. However, DDC states that EPA must also consider the proposed supplemental standards and the increase in useful life for heavy-heavy duty diesels when considering the issue of wether or not the 2004 NMHC+NOx standard is technologically feasible. In addition, in a footnote DDC states that they are not aware of any data which supports EPA's assertion that the 2004 standards are technologically feasible for urban buses. **(Detroit Diesel Corporation (IV-D-28))**

RESPONSE: The Agency has considered the full impact of all the proposed standards for HD diesel engines when addressing the issue of technological feasibility. As discussed in the NPRM's preamble and RIA, as well as the preamble and RIA for this final rule, we have looked at a wide range of technologies, and based on the data, we believe these technologies will enable HD diesel engines, including urban buses, to meet the 2004 NMHC+NOx standards for the full useful life of the engines. The 2004 standards will be in place for three years before the supplemental standards are in place. However, as discussed in the next issue section, EPA believes the supplemental standards will be feasible in the time frame provided. DDC states they are not aware of any data

which supports the Agency's conclusion that the 2004 standards are feasible for urban buses. However, in the NPRM, the Agency provided a long discussion of the NOx reductions which can occur from the combined use of advanced electronic controls, full authority second generation electronic fuel injection systems, advanced turbocharging systems, and high-flow cooled EGR. All of these technologies are just as applicable to urban bus engines as to other HD diesel applications. In addition, a number of the technologies described in the RIA are needed not only to lower NOx emissions but also to maintain PM emissions within the current standard of 0.1 g/bhp-hr (0.05 g/bhp-hr for urban buses), see Chapter 3(II) of the RIA (for example, SAE paper 980174 discussed in Chapter 3(II), section B which indicates advanced fuel injection systems with rate-shaping capabilities can reduce PM by up to 50 percent over conventional fuel injection systems). Current urban bus applications rely on a variety of emission control technologies to meet the current 4.0 g/bhp-hr NOx standard and the 0.05 g/bhp-hr PM standard; for example, certification data for model year 1999 diesel fueled urban bus engines show that all urban buses use diesel oxidation catalysts (DOC). These DOCs provide a relatively small reduction in particular matter, typically 10 to 20 percent, which, when combined with the additional technologies used on urban buses, including high swirl combustion chambers and high injection pressures, allow urban buses to comply with the 0.05 g/bhp-hr PM standard. DOCs can be used on urban buses today because urban buses operate at much lower speeds and loads than most heavy-duty vehicles which reduces the thermal stress on aftertreatment devices. Urban buses experience a typical duty-cycle for which aftertreatment equipment can be easily designed, as compared to truck engines which can be applied to several different types of truck applications and can experience a much wider range of duty-cycles. Some of these duty-cycles may be much more stressful than the duty-cycle of urban buses. Duty-cycle is important because the engines must be designed to meet the standards over their full useful lives. When combined with their current emission control strategies, the use of cooled EGR, advanced fuel injection systems, advanced turbochargers and electronic controls, urban bus engine manufacturers should be able to comply with the 2004 NMHC+NOx standard and the existing PM standard of 0.05 g/bhp-hr.

With respect to DDC's comment on the 435,000 mile useful life and sulfuric acid concerns, please see the response to comments under issue 7.3, Comment F.

COMMENT C: Several commenters urged EPA to increase the NOx reduction for 2004 HD diesel engines beyond the NOx reduction contained in the 1997 final rule. **(Several Private Citizens (IV-D-81 - 84, IV-D-108))**

RESPONSE: In our assessment of the appropriateness of the 2004 HDDE NMHX+NOx standard which was promulgated in 1997 we looked closely at the availability of emission control technology which could justify an NMHC+NOx standard lower than 2.4 b/bhp-hr. The analysis of the technologies we considered is contained in Chapter 3 of the RIA for this final rule. It is the Agency's technical opinion that emission control technologies which are capable of reducing NMHC+NOx below the 2004 standard promulgated in 1997 and reducing PM below the current standard of 0.10 g/bhp-hr (0.05 b/bhp-hr for urban buses) will not be viable in the 2004 time frame. As discussed in the RIA, we examined a number of promising technologies, including but not limited to passive PM traps and lean NOx adsorber catalysts, which are capable of producing large reductions in PM and NOx respectively. However, as discussed in the RIA, current diesel fuel sulfur levels inhibit the emission performance and/or long term durability of these devices, and they would not be viable for wide spread use in the 2004 time frame. The Agency has recently released an NPRM for new HDDE standards in the 2007 time frame which proposed very low PM and NOx standards based on

the use of aftertreatment, and this proposal includes significant reductions in on-highway diesel fuel sulfur levels in order to enable the use of advanced diesel aftertreatment devices for the HD industry. (See 65 FR 35429, June 2, 2000).

Issue 7.2 Heavy-duty Diesel PM Standard for 2004

COMMENT D: A large number of organizations and private citizens believe that EPA should finalize a more stringent particulate matter (PM) standard for HD diesel engines in 2004. Many of these organizations suggested that a PM standard of 0.05 g/bhp-hr was appropriate for 2004. Several commenters did not suggest a specific PM target, but urged EPA to tighten HD standards beyond those proposed for 2004. **(Sierra Club (IV-D-02), Private Citizens IV-D-03 & IV-D-46, Wasatch Clean Air Coalition (IV-D-40), State of Connecticut Department of Environmental Protection (IV-D-43))**. Some commenters did not specify a numeric standard, but suggested PM reductions of at least 50 percent. **(Private Citizens IV-D-04, IV-D-47, & IV-D-56, BroadLink Communications (IV-D-45))**

Many commenters pointed to a number of public health issues associated with PM, and in particular PM from diesel engines, as a reason why EPA should lower the PM standard for HD diesel engines. **(Sierra Club - Pennsylvania Chapter (IV-D-15), American Lung Association (IV-D-19), Northeast States for Coordinated Air Use Management (IV-D-26), STAPPA/ALAPCO (IV-D-32), Clean Air Network (IV-D-34), Wasatch Clean Air Coalition (IV-D-40), Coalition for Clean Air (IV-D-53))** Some of these comments included information on the toxic and non-toxic health effects of diesel PM. **(American Lung Association (IV-D-19))** Some commenters included estimates of city and/or regional inventory estimates of HD diesel engines and/or mobile source contribution to PM10 and/or PM2.5. **(American Lung Association (IV-D-19), Northeast States for Coordinated Air Use Management (IV-D-26), Coalition for Clean Air (IV-D-53), Environmental and Energy Study Institute (IV-D-77))**

The New York State Department of Environmental Quality cited the need for additional PM reductions in order to help attain and maintain the PM10 NAAQS, particularly for New York County, as another reason why EPA should lower the PM standard for HDDE to 0.05g/bhp-hr in 2004.

A number of the commenters pointed to a recent report by the Manufacturers of Emission Controls Association (MECA) as supporting data for their assertion that a 0.05 g/bhp-hr PM standard was technically feasible using diesel oxidation catalysts. **(American Lung Association (IV-D-19), STAPPA/ALAPCO (IV-D-32), Manufacturers of Emission Controls Association (IV-D-38), Wasatch Clean Air Coalition (IV-D-40), Environmental and Energy Study Institute (IV-D-77))** MECA submitted a copy of this report along with their written comments. The MECA report cited shows PM reductions from a 1998 HDDE up to 29 percent over the transient FTP, and a range of PM reductions over a 13 mode steady state test, between 0 and 67 percent, with one mode showing a PM increase of approximately 15 percent. All of this data was on current on-highway diesel fuel, sulfur content approximately 350 ppm. Data on low sulfur diesel fuel, 54ppm sulfur showed even greater PM reductions. MECA's comments also included in information on reductions in toxic hydrocarbons from the use of catalytic aftertreatment devices, as an example MECA cites information in their attached report which indicates a diesel oxidation catalyst on a 1998 HDDE operated on a fuel representative of current diesel fuel sulfur levels achieved nearly a 60 percent reduction in toxic hydrocarbon emissions (MECA).

STAPPA/ALAPCO went on to cite diesel PM trap data included in EPA's draft RIA for the NPRM as support for the technological feasibility of a 0.05 g/bhp-hr PM standard in 2004.

Some of the commenters pointed to the existing urban bus PM standard of 0.05 g/bhp-hr as support for their belief that all HD diesel engines should be capable of meeting a 0.05 g/bhp-hr PM standard in 2004 (Sierra Club - Pennsylvania Chapter, NESCAUM, Clean Air Network, NYS-DEC). NESCAUM also stated that EPA should ensure that as PM standards are lowered, PM particle numbers do not increase and overall particle size does not decrease. NESCAUM believe the use of PM traps will ensure this does not occur.

The Clean Air Network supported lowering diesel fuel sulfur to a 30ppm cap by 2004, and in combination a 0.05 g/bhp-hr PM standard in 2004. However, even without lower diesel fuel sulfur, they believed a 0.05 g/bhp-hr PM standard was feasible in 2004. **(Sierra Club (IV-D-02), Sierra Club - Pennsylvania Chapter (IV-D-15), American Lung Association (IV-D-19), Northeast States for Coordinated Air Use Management (IV-D-26)**, **STAPPA/ALAPCO (IV-D-32)**, **Clean Air Network (IV-D-34), Puget Sound Clean Air Agency (IV-D-36), Manufacturers of Emission Controls Association (IV-D-38)**, **Several Private Citizens (IV-D-03, IV-D-04, IV-D-46, IV-D-47, IV-D-56, IV-D-81 - 84, IV-D-108), Wasatch Clean Air Coalition (IV-D-40), NYS-DEC (IV-D-41), State of Connecticut Department of Environmental Protection (IV-D-43), BroadLink Communications (IV-D-45), Coalition for Clean Air (IV-D-53), International Center for Technology Assessment (IV-D-61), Environmental and Energy Study Institute (IV-D-77))**

RESPONSE: We did not propose, and this final rule does not contain, a new PM standard for HD diesel engines in model year 2004. The existing PM standard of 0.10 g/bhp-hr (0.05 g/bhp-hr for urban buses), will remain in effect for the 2004 model year. We do not disagree with the comments that additional reductions in PM for heavy-duty diesel engines are needed, and, in fact, the reduction in NOx emissions resulting from the standards in this rule will significantly lower secondary formation of nitrate PM.[2] However, based on the information available today and the statutory factors set forth in §202(a)(3)(A) of the Clean Air Act, we cannot conclude at this time that the current diesel PM standards should be lowered in 2004 in the context of an approximate 50 percent reduction in NOx. Because of the trade-off between NOx and PM emissions, manufacturers will have to undertake considerable effort to keep PM emissions below the current standard while essentially halving NOx emissions. The RIA for our NPRM and this final rule contains a discussion of the control technologies which we believe will be used to meet the lower NMHC+NOx standard and the existing 0.10 g/bhp-hr PM standard in the 2004 model year.

Our assessment of diesel oxidation catalyst technology (DOC) can be summarized by the following points. First, current diesel fuel sulfur levels can inhibit the performance of DOC's, thus degrading their emission control potential. Second, DOC's have not been shown to provide reductions in PM for 2004 technology HD diesel engines large enough to support an across the board 0.05g/bhp-hr standard for PM in 2004.

Our assessment of diesel particulate traps for 2004 can be summarized by the following point. In the 2004 time frame, considering current diesel fuel sulfur levels, diesel particulate traps

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[2]Benefits of Mobile Source NOx Related Particulate Matter Reductions, October 1996, EPA Contract No. 68-C5-0010.

have not been shown to be durable in-use, principally because of difficulties with reliable generation methods (which are hindered by diesel fuel sulfur). Additional information on this issue is presented in the RIA for the NPRM and the RIA for this final rule.

Several commenters point to the recent MECA report as evidence that a 0.05 g/bhp-hr PM standard is achievable.

First, the commenters point to the fact the baseline 1998 technology HD engine MECA relied on started at a PM level of 0.07. Second, the MECA report indicates DOC technology used on this engine was capable of achieving a PM level on the HD-FTP of 0.048 g/bhp-hr. We believe this analysis is flawed in several respects.

In responding to this comment, we have examined publically available model year 1999 and model year 2000 federal certification data for diesel fueled HD diesel engines, this information is summarized in a memorandum to this docket[3]. The engine tested by MECA was a 12.7 liter, 1998 Detroit Diesel series 60 engine. Examination of the recent certification data shows that for 1999, this engine was certified with a PM level of 0.1 g/bhp-hr. The MECA report does not show that a PM level of 0.05 g/bhp-hr can be achieved with a DOC on an engine using cooled EGR, and cooled EGR is the principal technology which will be utilized to meet the 2004 NMHC+NOx standard. To the contrary, Figure 4 on page 7 of the MECA final report submitted with their written comments (docket item IV-D-38), shows that when cooled EGR was added to the engine, PM emissions increased from the baseline level of 0.07 g/bhp-hr to approximately 0.20 g/bhp-hr over the transient heavy-duty FTP. The application of a DOC combined with a fuel borne catalyst to the EGR equipped engine lowered PM emissions to 0.13 g/bhp-hr over the FTP. As discussed in the RIA for our proposal and in the RIA for this final rule, the combination of technologies we believe will be used by manufacturers to meet the 2004 standards are not only to lower NOx emissions, but also to continue to meet the existing PM standard of 0.10 g/bhp-hr. If DOC's are used on MY2004 engines, they will be used to provide small PM reductions (~10 - 20 percent) in order for the engines to comply with the current PM standard of 0.10 g/bhp-hr.

The ability of urban buses to achieve a PM level of 0.05 g/bhp-hr does not necessarily mean that this level is feasible for all heavy duty diesel engines. Urban buses operate at much lower speeds and loads than most heavy-duty vehicles which reduces the thermal stress on aftertreatment devices. Most urban bus operators have maintenance facilities which can handle any special maintenance needs related to emission control equipment. Urban buses experience a typical duty-cycle for which equipment can be easily designed, as compared to truck engines which can be applied to several different types of truck applications and can experience a much wider range of duty-cycles. Some of these duty-cycles may be much more stressful than the duty-cycle of urban buses. Duty-cycle is important because the engines must be designed to meet the standards over their full useful lives. Requiring a small subset of engines to meet a more stringent standard does not necessarily justify the feasibility or cost-effectiveness of the standard for all heavy-duty engines. Finally, urban buses are under congressional mandate for lower PM emissions because they operate in heavily populated areas where higher costs are justified. This is not to say that it would be impossible or inappropriate for the Agency to mandate a PM standard lower than 0.10 g/bhp-hr

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[3] See "Summary of Recent Model Year Heavy-duty Diesel Fueled Engine Certification Data", EPA Memorandum, Available in EPA Air Docket A-98-32, Docket Item # YYYY

for all heavy-duty engines in the future, but, as discussed above, there are a number of issues which must be addressed, and we do not believe this will occur by 2004.

As discussed above, one of the principle road blocks of a lower PM standard for HDDEs is the current level of sulfur in on-highway diesel fuel. It is likely that lower diesel fuel sulfur levels would enable PM traps in the future which would allow the Agency to establish much tighter PM standards for HDDEs in the future. The Agency has recently published an NPRM which seeks to lower on-highway diesel fuel sulfur levels and on-highway HDDE emission standards in the 2007 time frame. (See 65 FR 35429, June 2, 2000)

COMMENT E: The American Petroleum Institute commented that the commercial viability of diesel PM aftertreatment devices which have shown some sensitivity to sulfur levels is not currently assured. API comments that PM trap regeneration and in-use durability issues must still be resolved. Until these issues are resolved, API believes it would be premature to set a PM standard more stringent than 0.10 g/bhp-hr for the 2004 model year. **(American Petroleum Institute (IV-D-23))**

RESPONSE: We agree with the comment that there are regeneration and in-use durability issues with particulate traps which must be addressed before this technology can have wide-spread application to the heavy-duty diesel market.

Issue 7.3 Diesel Fuel Quality, Useful Life and Stringency of Standards

COMMENT F: EMA commented that EPA has failed to provide manufacturers with low sulfur diesel fuel in order to meet the proposed 2004 standards. EMA comments that the use of cooled EGR, the likely technology manufacturers will use to meet the 2004 standards, with current on-highway diesel fuel sulfur levels will result in a variety of engine wear problems; including the valves, rings, cylinder liners, sensors, EGR Coolers, and turbochargers. EMA commented that manufacturers will be using more EGR than was previously anticipated to meet the proposed 2004 requirements. EMA commented that the extended useful life for heavy-heavy duty diesels from the current 290,000 miles to 435,000 miles in 2004 will exacerbate the durability challenges manufactures will face in 2004. For these reasons, EMA believes there is an overwhelming need for lower on-highway diesel fuel sulfur levels in 2004. EMA makes several recommendations. EPA should lower diesel fuel sulfur levels to approximately 100 to 150 ppm by 2004. In the event EPA does not lower diesel fuel sulfur in 2004, EPA should reduce the stringency of the 2004 standards to allow lower amounts of EGR, no specific standard level or acceptable level of EGR was suggested. Finally, if neither of these options are considered, EPA should relax the useful life requirement in 2004 back to the current requirement of 290,000 miles.

Mack Truck Corp. (IV-D-06) commented that current diesel fuel sulfur level combined with the EGR technology which will be needed for the 2004 standards will result in increased engine wear and reduce the useful life of HDDEs. Mack supports and requests a significant reduction in on-highway diesel fuel sulfur prior to model year 2004. Specifically, Mack recommends a fuel sulfur level of 100 - 150 ppm by 2004. Mack commented that they submitted to EPA confidential business information regarding a test program they conducted at Southwest Research Institute which showed a significantly higher cylinder liner wear rate with the use of EGR. As a result of this increase in liner wear, Mack requests a reduction in diesel fuel sulfur. Mack commented that if no reduction in diesel fuel sulfur is provided, EPA should reduce the stringency of the standard to reduce the amount of

EGR required. Mack did not comment on a specific stringency or a specific amount of EGR which would be appropriate if no reduction in fuel sulfur was provided.

Detroit Diesel Corporation commented that they are concerned the 2004 NMHC+NOx standard, in combination with the proposed supplemental standards, may not be feasible for 435,000 mile useful life using cooled EGR. DDC states the use of cooled EGR to meet the proposed standards, in combination with current on-highway diesel fuel sulfur levels, may result in sulfuric acid formation, which will have a deleterious effect on engine systems. DDC states EPA did not provide any data to indicate technologies such as cooled EGR can provide 435,000 miles of effective emission control. **(Engine Manufacturers Association (IV-D-05), Mack Truck Corp. (IV-D-06), Detroit Diesel Corporation (IV-D-28))**

RESPONSE: We disagree with these comments. We did not propose, and this final rule does not contain, any changes in the 2004 standards, the 2004 useful life requirements for HD diesel engines; nor have any changes been made to diesel fuel quality for the 2004 time frame in this final rule action. EMA and DDC comment that the use of cooled EGR with current on-highway diesel fuel sulfur will result in a variety of engine durability problems. However, no data was provided. In our proposal (see 64 FR 58484 - 48485, also Chapter 3 of draft RIA available in EPA Air Docket A-98-32, Docket Item # III-B-01) and in the RIA for this final rule, we have discussed the issues associated with the use of cooled EGR and the formation of sulfuric acid and water condensation. Based on the information from publicly available research papers which are summarized and discussed in Chapter 3 of our RIA for this final rule, we believe manufacturers will employ a number of techniques to minimize the potential negative impacts of cooled EGR on engine performance and durability. These efforts will only be summarized here: first, the use of high-pressure EGR to avoid turbocharger fouling; second, thermostatically controlled engine coolant for EGR coolant to keep EGR temperatures above the exhaust's water vapor dew point to minimize sulfuric acid formation; third, careful selection of corrosive resistant materials and good bonding process selection for EGR cooler construction including the use of higher nickel or cobalt alloy stainless steel; and finally, improvements to engine oils to maintain total base number control.

It is difficult in a public format to comment on the CBI data provided by Mack in any detail. EPA cannot rely on non-public CBI data in promulgating this rule. However, the Agency requested additional information from Mack regarding their test program at Southwest Research Institute on EGR wear, and the information which was requested was not provided. Without the requested information from Mack it was not possible for us to evaluate their report. Manufacturers utilize a variety of accelerated laboratory aging procedures to simulate engine wear, and to evaluate various hardware components. HD diesel engines have not utilized EGR in the past and the procedures to properly perform accelerated EGR tests, including wear tests, are not well established. As discussed in the RIA, condensation of sulfuric acid and water in an EGR equipped system is sensitive to a number of factors, including pressure, dew point, water content of the exhaust, sulfur content of the exhaust, EGR inlet gas temperature, EGR coolant temperature, and manifold gas temperature. In addition, as discussed in the RIA, the choice of EGR system materials (EGR plumbing, EGR valve, EGR cooler) and intake manifold materials as well as the material bonding process selected is critical to the durability of the engine system. The CBI information provided by Mack was not sufficient for the Agency to reverse our conclusion that the 2004 standards can be achieved with the use of EGR for the full useful life of HDDEs. EPA continues to believe that manufacturers have the ability, through the process discussed above and in the RIA, to insure that the engines they build to meet the 2004 standard are sufficiently durable.

Based on this information, and the lack of substantive comments from the manufacturers, no relaxation in the useful life requirements for 2004 HD diesel engines has been finalized, and no change in diesel fuel quality for 2004 have been provided. See also response to comments under Issue 11.

Finally, a number of commenters did not specify whether or not their concerns regarding diesel fuel quality and useful life were regarding the HD2004 FTP standards or the proposed supplemental requirements. With respect to the supplemental test requirements (not-to-exceed and supplemental steady-state test requirements) and useful life, the Agency has finalized provisions which address the manufacturers' useful life concerns regarding the NTE requirements. Specifically, the final rule contains specific regulatory provisions for excluding engine operation from the NTE standard during defined operating conditions which can lead to engine corrosion. These operating conditions are outside of the FTP operating conditions. Hence no change in the 2004 FTP requirements are provided. Additional discussion on this issue can be found under Issue 8.

COMMENT G: The Massachusetts Department of Environmental Protection supported the Agency's reaffirmation of the 2004 2.4 g/bhp-hr NMHC+NOx standard with no change in diesel fuel quality. The American Trucking Associations (ATA) commented that EPA should make no changes in the 435,000 mile useful life requirement for 2004. ATA commented that the 435,000 mile useful life is very important to it's members. The long useful life period gives greater assurances that new technologies, such as EGR, will remain robust for the greatest period possible. The American Petroleum Institute (API) commented that they concur with the Agency's conclusions that no change in diesel fuel quality is necessary to achieve the 2004 HD standards. API comments that engine manufacturers have a variety of cost-effective options to address the durability concerns due to the use of cooled EGR with current diesel fuel sulfur levels, and they concur with API comments that these options include EGR cooler design and material selection, such as the use of specially treated stainless steel. The National Automobile Dealers Association supports a 435,000 mile useful life for HD diesel vehicles. The Massachusetts Department of Environmental Protection supported the Agency's reaffirmation of the 2004 2.4 g/bhp-hr NMHC+NOx standard with no change in diesel fuel quality. **(Massachusetts Department of Environmental Protection (IV-D-12), The American Trucking Associations (IV-D-21), American Petroleum Institute (IV-D-23), National Automobile Dealers Association (IV-D-31))**

RESPONSE: We agree with these comments. We did not propose, and this final rule does not contain, any changes to the 2004 useful life requirements for HD diesel engines. As discussed in response to Issue 7.3, Comment E, based on existing information in the literature which was cited and discussed in our proposal and the RIA for this final rule, EPA believes manufacturers have a number of options to minimize the potential negative effects on engine life due to cooled EGR.

Issue 7.4 Diesel Vehicle Chassis-based Standards

COMMENT H: Two commenters urged EPA to require complete heavy-duty diesel vehicles under 14,000 pounds GVWR to be subject to chassis-based standards. These commenters stated that doing so would: (1) enable the setting of fuel-neutral standards under 14,000 pounds GVWR; (2) facilitate in-use testing of diesels under 14,000 pounds GVWR; and (3) simplify inspection/maintenance programs. **(NESCAUM (IV-D-26), STAPPA/ALAPCO (IV-D-32))** Another commenter stated that a chassis-based program for heavy-duty diesels up to 14,000 pounds GVWR

would add complexity, increase compliance burdens, and likely have poor cost-effectiveness. **(Navistar (IV-D-29))**

RESPONSE: We did not propose to subject complete heavy-duty diesel vehicles to chassis-based standards. The proposal requested comment on the possibility of allowing or requiring this in the context of future regulations regarding heavy-duty emission standards. The proposal and this final rule make the case that, in the 2004/2005 time frame, considering available technology and fuels, heavy-duty Otto-cycle engines and vehicles are capable of significantly lower emissions than heavy-duty diesel engines. However, we intend to reevaluate this in the context of more advanced technologies and cleaner fuels, and to that end we requested comment on these issues in a more recent proposal (see 65 FR 35430, June 2, 2000). EPA agrees with Navistar that a requirement for chassis-based testing of complete heavy-duty diesels below 14,000 pounds GVWR in the 2005 model year would add extra complexity. Such a required would also create an increased test facility burden for manufacturers that would have to transition to chassis-testing a greater percentage of their vehicles. In addition, we chose in this rule to create a program harmonized to a great degree with the requirements in place in California, enabling manufacturers to meet a single set of requirements nationwide. Although California allows chassis-testing of diesels to their Medium-Duty Vehicle program, chassis testing is not required for diesels. We are not aware of any manufacturers that choose to comply with the Medium-Duty Vehicle chassis-based standards; rather, manufacturers have opted for the engine-based standards allowed as an alternative under the California regulations. Given this, we are finalizing the program as proposed, but we will review the appropriateness of chassis-based standards for diesel vehicles below 14,000 pounds GVWR in the context of the recent proposal for later model year engines.

COMMENT I: A commenter raised some specific questions regarding proposed section 86.001-1 of the regulations. First, the commenter notes that paragraph (b)(1), which gives manufacturers the option to certify any heavy-duty vehicle up to 14,000 pounds GWVR as a light-duty truck through the 2003 model year, does not specify the model year that the provision takes effect. Second, they state that it is unclear why the provision in paragraph (b)(2), which allows manufacturers to certify Otto-cycle heavy-duty vehicles up to 14,000 pounds GVWR to the provisions for complete Otto-cycle heavy-duty vehicles in subpart S of part 40 CFR part 86 starting with the 2001 model year, does not extend to diesel vehicles. This commenter also asked why the provision in paragraph (b)(2) differs from (b)(1) in that it does not have a sunset date. **(Detroit Diesel Corporation (IV-D-28))**

RESPONSE: Paragraph (b)(1) of proposed 40 CFR 86.001-1specifes the provision known as the "heavy-as-light" certification option. This option, which is currently in place, has allowed manufacturers to certify vehicles above 8,500 pounds GVWR to chassis-based light-duty truck standards if they found it desirable to so. With the exception of this provision, all vehicles above 8,500 pounds GVWR are required to meet engine-based standards under the current compliance program. This specific provision, which revises the pre-existing "heavy-as-light" option, takes effect with the 2001 model year, as indicated by the section numbering. The regulations in subpart A of 40 CFR part 86 state that the provisions of a given section take effect in the model year indicated by the three digits following the period of the section number, in this case "001." The provision in paragraph (b)(1) sunsets because the regulations promulgated in this rule require Otto-cycle heavy-duty vehicles up to 14,000 pounds GVWR to meet chassis-based standards. Because of the vast differential between the light-duty truck emission standards and the heavy-duty diesel engine standards, particularly in later model years when light-duty trucks will be meeting Tier 2 standards,

we do not expect the “heavy-as-light” provision to be attractive to manufacturers. Therefore, we have also chosen to sunset this provision for diesel vehicles. The final rule revises the proposed language slightly to be consistent with the three programs available to Otto-cycle engine manufacturers. Under the final regulations, the sunset date can be the 2002, 2003, or 2004 model year depending upon which of the optional Otto-cycle programs the manufacturer chooses to use.

The provision in paragraph (b)(2) of proposed 40 CFR 86.001-1 allows manufacturers to meet upcoming Otto-cycle requirements early in order to generate credits for averaging, banking, and trading (ABT). This paragraph does not apply to diesel vehicles because the ABT requirements to which it refers apply only to Otto-cycle vehicles. Unlike diesels, the final rule requires complete Otto-cycle vehicles to transition from standards in units of g/bhp-hr (in subpart A of 40 CFR part 86) to standards in units of g/mi (in subpart S of 40 CFR part 86). Thus, in order to bank credits to meet the future standards, complete Otto-cycle vehicles must bank credits in g/mi units, meaning that early credits must be generated according to the chassis-based provisions in subpart S. Paragraph (b)(2) is required to enable this early banking to occur. As noted above, we have not finalized provisions for chassis-based standards for diesel vehicles. Thus early banking for diesels is done according to the engine-based requirements in subpart A of 40 CFR part 86. The provision in paragraph (b)(2) does not require a sunset date because it is essentially sunsetted when meeting such requirements is no longer optional, which could be the 2003, 2004, or 2005 model year depending upon which of the optional Otto-cycle programs the manufacturer chooses to use.

Issue 7.5 Other Heavy-duty Diesel Issues

COMMENT J: One commenter mentioned solar electric, solar hydrogen, fuel cell electric and direct solar hydrogen engines as alternative technologies. **(Private Citizens (IV-D-50 & IV-D-88))**

RESPONSE: These comments did not present sufficient information on which to justify a change in the proposed standards. We are not aware of any solar or fuel cell technology for heavy-duty applications which would support the justification of lower standards for HD gasoline or diesel engines in the 2004 time frame.

COMMENT K: Engelhard submitted comments on their PremAir catalyst technology. The PremAir catalyst would provide significant air quality benefits. EPA should allow manufacturers to use and receive credit for the application of this technology in complying with the HD 2004 emission requirements (both diesel and Otto-cycle).The PremAir catalyst (developed by Engelhard) directly reduces ozone pollution from the ambient air. This new technology involves coating the surface of a heat exchanger, such as an automotive radiator, so that the ozone in the ambient air that passes across and through the heat exchanger is converted to oxygen. By operating at near-ambient temperatures and utilizing heat-exchange systems associated with "streams" of large quantities of ambient air for other purposes (e.g. dissipating heat), the technology offers a new opportunity to reduce the public's exposure to unhealthy levels of ozone. Because of the potential air quality benefits of the PremAir catalyst when applied to motor vehicle radiators, CARB decided in November 1998 to allow automobile manufacturers to receive credit for applications of this technology in complying with the LEV program requirements. Engelhard believes the comments they submitted in response to EPA’s Tier 2 proposal are also applicable to EPA’s HD 2004 proposal, and the bulk of Engelhard’s comments is a copy of their Tier 2 comments. In particular, Engelhard believes the modeling methodology and testing procedures in their Tier 2 comments are especially well-suited for the heavy light-duty trucks in the 8,500 to 10,000lb GVWR range noted in

the proposal by EPA which will typically function as personal transportation vehicles.

EPA should develop an approach which would allow HD manufacturers to receive emission credits for applying this technology. In their comments, Engelhard provides a significant amount of discussion, analysis, modeling data and recommendations regarding the application of this technology to LD vehicles for the Tier 2 program. **(Engelhard Corporation (IV-D-9), all pages)**

RESPONSE: We appreciate the comments from Engelhard on the PremAir technology. In response to Engelhard's Tier 2 comments, EPA promulgated procedures similar to CARB's for certifying such technologies and determining the appropriate VOC credit for light duty vehicles and trucks. However, Engelhard has offered no specific recommendations on how this technology would be applied to the HD market, no data was supplied on the application of this technology to HD engines or vehicles, and no specific recommendation was made on the issue of granting HD engine manufacturers emission credits for using this technology. The comments provided by Engelhard described test procedures and modeling scenarios specific to the use of the PremAir technology on light-duty applications using the light-duty FTP, which would then generate emission credits on a gram/mile basis. It is unclear how this approach would be applicable to the heavy-duty engine and vehicle market, where for the majority of the market, the engines are certified to a gr/bhp-hr standard using an engine dynamometer, which does not even involve the testing of the radiator they engine may eventually see once it's placed in a vehicle application.

Engelhard did not provide recommendations for how to address these issue. Because we proposed no procedures regarding the use of this type of technology, and the commenter did not suggest any specific to HD engines and vehicles none are contained in this final rule. Engelhard commented that they believe their Tier 2 comments, which were also submitted in response to this rule, were particularly relevant for the 8,500 - 10,000lb GVWR vehicles used primarily for personal transportation vehicles. This comment suggests that there may be reasons why the technology or the credit generation method suggested by Engelhard are not appropriate for HD engines and vehicles. The Agency has not come to this conclusion, however, we also did not perform an evaluation of the technology as it could apply to HD engines and vehicles because of the limited information presented by the commenter, as well as the lack of time and resources to perform an independent analysis in the time frame of this rulemaking.

As discussed in the response to Issue 26, in the Tier 2 final rule the Agency created a new category of heavy-duty vehicles called medium duty passenger vehicles (MDPV), and the provisions established in the Tier 2 final rule which would allow the PremAir technology to generate appropriate credits could be used for these MDPVs.

With respect to the detailed comments on the Tier 2 rulemaking, these comments were addressed in the Tier 2 final rule.

COMMENT L: General Motors Corp. & Isuzu Motors America Inc. (GM/Isuzu) commented the Agency's feasibility determinations are invalid because they impermissibly rely on non-public data. GM/Isuzu comment that the Agency stated in the preamble for the proposal regarding the HD diesel consent decrees "The fact that these engine manufacturers have agreed to meet the 2004 standards in 2002 gives the Agency additional confidence that the NMHC+NOx standard being reaffirmed in today's proposal is appropriate for the 2002 model year" See 64 FR 58483. GM/Isuzu comment that therefore the Agency is relying on confidential data developed as a result of these

consent decrees for the feasibility determinations, and therefore such a determination is invalid in the rulemaking process. **(General Motors Corporation and Isuzu Motors America Incorporated (IV-D-65))**

RESPONSE: We disagree with these comments. The Agency has not relied on any data for this final rule which is not part of the public docket established for this rulemaking action. The citation quoted by GM/Isuzu states that it is the existence of the consent decrees which provides the Agency with additional confidence, not any data which may have been developed during the HD diesel consent decree process. In addition, the Agency has not relied on the existence of the consent decrees in making the determination that the 2004 HD diesel NMHC+NOx FTP standards are appropriate. "Additional confidence" indicates the Agency already had sufficient information and data to determine the 2004 standards are appropriate, which is the case.

COMMENT M: Caterpillar Inc. submitted comments stating that the emission standards applicable to heavy duty engines are measured under transient conditions and that there is no support for EPA's claim that the transient emission standards for HDDEs were and are applicable under all operating conditions by virtue of the defeat device policy.
(Caterpillar Incorporated (IV-D-37))

RESPONSE: EPA's defeat device definition applies on its face to AECDs that reduce the effectiveness of the emission control system "under conditions which may reasonably be expected to be encountered in normal urban vehicle operation and use," unless the AECD meets certain specified exceptions. While EPA's preexisting FTP may have emphasized transient operation, the defeat device definition clearly is intended to apply to all operating conditions, including steady state operation. Issues regarding EPA's current and future defeat device regulations are dealt with in greater detail in Issue 21.

ISSUE 8: SUPPLEMENTAL STANDARDS FOR HEAVY-DUTY DIESEL ENGINES

Issue 8.1 General Support for the Supplemental Standards

COMMENT A: A number of commenters provided general support for the proposed supplemental requirements. The Massachusetts Department of Environmental Protection commented that HDDE test procedures should reflect real world in-use operation over a broad range of in-use speeds and loads, and they therefore support the proposed NTE, SSS, and the load response test. The American Lung Association also provided broad support for all aspects of the proposed supplemental standards. ALA also commented that the existing HDDE FTP engine cycle is not sufficient to ensure emissions are controlled over the broad range of in-use operation, and SSS and NTE will help ensure emissions are controlled over this broader range. ALA noted that the prohibition on defeat devices is not a quantified numerical standard, and, as a result, it is harder to ensure that engines operate with the same level of control in the real world as under the test procedures. ALA also supported the NTE because it could be an effective element of an in-use testing program. ALA also supported the proposed NTE and MAEL because the tests could be performed under any ambient condition, not just those specified by the existing HDDE FTP.

The American Petroleum Institute (API) supports the establishment of the supplemental emission standards and test procedures for HDDEs. API commented that the existing FTP duty cycle represents a narrowly defined transient driving condition. API commented that the SSS and the NTE will encourage the development of emission control technology for HDDEs which are more robust in design with respect to real-world conditions. In addition, API commented that the SSS represents a positive step towards international harmonization of standards because it is consistent in many respects with the European EURO III ESC test.

The Northeast States for Coordinated Air Use Management (NESCAUM) supported the addition of the SSS, the NTE, and the LRT to the existing FTP for HDDEs. NESCAUM commented that the SSS is consistent with the European EURO III ESC test, and mimics engine conditions found in over-the-road driving conditions which are more representative of long haul driving conditions than the existing FTP duty cycle. NESCAUM also supports the proposal for EPA to be able to select three additional steady-state points (“mystery points”) to ensure the engine emissions do not peak outside of the 13 mode test points. NESCAUM supported the NTE for a number of reasons, including it’s ability to enable in-use testing of HDDEs, and the expanded ambient conditions under which the proposed NTE applies.

The State and Territorial Air Pollution Program Administrators and the Association of Local Air Pollution Control Officials (STAPPA/ALAPCO) also provided broad support for all aspects of the proposed supplemental test requirements and standards. The Manufacturers of Emission Controls Association supported the proposal to make the certification test procedures for HD engines more representative of real world driving conditions.

The New York State Dept. of Environmental Conservation (NYS-DEC) supported EPA’s proposal to revise and update testing procedures. NYS-DEC commented testing revisions which includes steady state cruise at highway speeds provide certification results more indicative of emission levels at highway speeds. NYS-DEC also commented the proposed NTE requirements will force engine manufacturers to produce clean vehicles regardless of the operating mode.

The City of Los Angeles supported the establishment of rigorous in-use compliance verification standards and procedures. The Coalition for Clean Air supported the implementation of additional testing and standards to ensure in-use compliance for HD diesel engines and vehicles.

The State of Missouri Department of Natural Resources (M-DNR) supported the proposed new in-use emission standards for HDDE, in particular the establishment of strict NTE limits for HDDE. M-DNR commented that EPA should ensure that the use of defeat devices or any other technology which would allow HDDE to emit at levels far beyond the applicable standards be prohibited for new trucks.

The Environmental and Energy Study Institute supported the codification of the HD diesel consent decree requirements to make real-world emission control more likely. The Ozone Transport Commission supports the Agency's proposal to include test procedures that accurately report in-use emissions from HD engines.

(Massachusetts Department of Environmental Protection (IV-D-12), American Lung Association (IV-D-19), American Petroleum Institute (IV-D-23), Northeast States for Coordinated Air Use Management (IV-D-26), State and Territorial Air Pollution Program Administrators and the Association of Local Air Pollution Control Officials (IV-D-32), Manufacturers of Emission Controls Association (IV-D-38), New York State Dept. of Environmental Conservation (IV-D-41), City of Los Angeles (IV-D-49), Coalition for Clean Air (IV-D-53), State of Missouri Department of Natural Resources (IV-D-63), Environmental and Energy Study Institute (IV-D-79), Ozone Transport Commission (IV-D-79))

RESPONSE: We agree with these comments. As discussed in the proposal, we also believe that the somewhat limited type of driving conditions reflected in the existing FTP for HDDE in combination with the defeat device prohibition is not the most effective approach in the long term to ensure appropriate emission control from HDDEs under all conditions in use, and therefore the supplemental test requirements are necessary and appropriate for HDDEs. As discussed in the preamble for this final rule (See Section III(A)(2) of the preamble), we proposed to implement these new requirements in model year 2004, however, due to issues regarding the lead time and stability requirements for HDDE standards we are implementing the supplemental standards in the 2007 model year. As discussed below, we have made a number of changes to the proposed SSS, NTE, and MAEL requirements, but these changes have only been made to eliminate redundancies, provide clarification, or address issues of technical feasibility, and in general the overall intent and purpose of the proposed supplemental requirements which were supported by these commenters remain unchanged.

Issue 8.2 Relationship between Statement of Principles and the Supplemental Standards

COMMENT B: The Engine Manufacturers Association, Navistar International Transportation Inc., DaimlerChrysler, General Motors Corp., and Isuzu Motors America Inc. commented that the proposed supplemental standards were inconsistent and/or contradictory with the 1995 Statement of Principles (SOP) signed by a number of engine manufacturers, the Agency, and the California Air Resources Board. The GM/Isuzu comments state the proposal "departs impermissibly" from the SOP. **(Engine Manufacturers Association (IV-D-05), Navistar International Transportation Corp. (IV-D-29), DaimlerChrysler (IV-D-44), General Motors Corporation and Isuzu Motors America Incorporated (IV-D-65))**

RESPONSE: We disagree with these comments. The SOP, which is discussed in more detail in the preamble for this final rule, by its terms was intended to provide the basis for an NPRM which the Agency published in 1996 for HDDEs. The SOP did not, indeed, it could not, constrain EPA, or limit EPA's discretion in any way, legally or otherwise. In essence it is a public statement of EPA's intentions concerning the contents of an upcoming proposal, with the understandings of various parties who agree with EPA's intention. It recognizes EPA's obligation and intention to follow the SOP discussions with a public rulemaking process.

EPA has been clear throughout this process that the SOP does not bind the Agency from considering other information and making appropriate decisions for future rulemakings, including the proposal which led to this final rule. Moreover, the SOP was completed prior to the events that led to the heavy-duty diesel consent decrees which, in turn, led in part to the supplementary requirements in this final rule.

Issue 8.3 Impact of Supplemental Standards on Stringency

COMMENT C: EMA commented that the proposed supplemental requirements (NTE, Supplemental Steady State test, load response test and MAEL) and the proposed expanded ambient conditions significantly increase the stringency of the existing standards. EMA commented that each of the new supplemental tests considered alone impact the stringency of the standards, as well as the expanded temperature and altitude requirements. A similar comment was made by Navistar International and DaimlerChrysler. **(Engine Manufacturers Association (IV-D-05), Navistar International Transportation Corp. (IV-D-29), DaimlerChrysler (IV-D-44))**

RESPONSE: The intent of this comment is unclear. As discussed in the proposal and in this final rule, the Agency has evaluated all of the proposed requirements and as promulgated in this final rule the requirements are appropriate under the Agency's authority under the Clean Air Act. We have not changed the FTP standards for 2004 which were promulgated in 1997, therefore we have not effected the stringency of the 2004 FTP. In this final rule we have established separate standards which we have determined are technologically feasible by model year 2007 and are otherwise appropriate under the Clean Air Act. We address below the specific issues of technological feasibility which were raised in EMA's and other commenters submissions.

Issue 8.4 Relationship between HD Consent Decrees and the Supplemental Standards

COMMENT D: Caterpillar and Navistar International commented that the consent decrees between the federal government and a number of heavy-duty engine manufacturers which were signed in October of 1998 do not establish the feasibility of the proposed supplemental requirements. Navistar also commented that the Agency's sole basis for determining the technological feasibility of the proposed standards is the fact that some engine manufacturers agreed to meet supplemental emission limits as part of their consent decrees.

General Motors Corp. & Isuzu commented that the consent decrees do not provide a basis for promulgating the new proposed standards and test procedures. **(Navistar International Transportation Corp. (IV-D-29), Caterpillar Inc. (IV-D-37)**, **General Motors Corporation and Isuzu Motors America Incorporated (IV-D-65))**

RESPONSE: In our proposal and in this final rule, we have clearly articulated that while the consent decrees, and the events and discoveries that led to these consent decrees, do provide

some of the background context for some of the provisions in this rulemaking, the consent decrees themselves to not establish the technological feasibility of the supplemental standards contained in this final rule. We have performed our own assessment of the supplemental standards that were discussed in the proposal in full and that are contained in this final rule, and after careful consideration of the comments we received from the public, and after making appropriate changes from our proposal, we have determined the supplemental standards are technologically feasible by model year 2007 and are otherwise appropriate under the Clean Air Act.

We disagree with the comments from Navistar that the existence of the consent decrees is the sole basis for the Agency's determination that the supplemental requirements are technologically feasible. As discussed above, we have made our own determination regarding the feasibility of the supplemental standards in model year 2007, and this determination is supported by the factual information contained in the record for this rulemaking. Factual information that resulted from the consent decrees is included in this supporting information.

While this information and analysis, on its own, is adequate support for the supplemental standards, the existence of consent decrees that cover six of the largest on-highway HD diesel engine manufacturers in the U.S. and require compliance with these kinds of supplemental requirements several years before they are required under this rule provides additional support that EPA's technical feasiblity and other conclusions are reasonable and appropriate.

Regarding the comments from GM/Isuzu, while the consent decrees themselves do not demonstrate either the appropriateness or the feasibility of the supplemental standard, the issues raised by the enforcement case which lead to the consent decrees, including the potential for large differences in emissions between HDDEs operated during the FTP as compared to real-world operation, does provide important background information which the Agency used in formulating the proposal and this final rule.

Issue 8.5 Goals of and Need for the Supplemental Requirements

COMMENT E: DaimlerChrysler commented that the goals of the proposed steady state test and the NTE is to assess the emission performance under steady-state on-highway operation. DC does not believe the proposed tests will accomplish the goals EPA envisions. DC believes the proposed tests will only increase burdens on HDDE manufacturers, and in fact may decrease overall fuel efficiency of HDDEs with little or no reduction in emissions.

General Motors Corp. and Isuzu commented that the supplemental requirements are not needed because 90 percent of the HD engines will need to meet these requirements under the consent decrees. **(DaimlerChrysler (IV-D-44)**, **General Motors Corporation and Isuzu Motors America Incorporated (IV-D-65))**

RESPONSE: We disagree with these comments. As discussed in the preamble to the proposal and for this final rule, there are several reasons why the SSS and NTE requirements are necessary for HDDEs. The SSS test covers steady-state engine operation in a region of the engine operating map not adequately covered by the existing HDDE FTP but which is typical of modern HDDE operation. This is well supported by a number of recent studies. See Docket Items II-D-11 and II-D-21, available in the docket for this rule (EPA Air Docket A-98-32). The purpose of the NTE is not only to assess emission performance under steady-state on-highway operation, but under any engine operation within the NTE control zone, both steady-state and transient engine operation.

The NTE not only assesses emission performance, it caps the highest emissions which can occur during NTE operation with a standard equal to 1.25 times the FTP standard. The SSS and NTE will ensure HDDE emissions are controlled over a wide range of engine operation typical of HDDEs. Regarding the comment on a decrease in fuel efficiency, the commenter provides no data to support this assertion. In the RIA for this final rule, we included a detailed discussion of the emission control technologies available to engine manufacturers which are capable of achieving the 2004 FTP and the 2007 NTE and SSS standards, including the impact of these control technologies on fuel economy. We see no reasons why overall fuel economy from HDDEs will decrease due to the supplemental standards (See Chapter 3 of the RIA for this final rule). The commenter suggests the supplemental requirements will not produce any environmental benefit, which actually seems to contradict the commenter's comments regarding stringency. We disagree with this comment. EPA's goal is to ensure real-world emissions control over the broad range of in-use speed and load combinations that can occur, rather than just controlling emissions under certain laboratory conditions. EPA's 1997 HD diesel rule was based on the expectation that this would be the case. The 1997 rule's projected emissions benefit, expected control technology, cost, and cost-effectiveness were derived with the belief that the engines would be meeting the standards in-use under typical operating conditions. The supplemental provisions included in today's final rule for HD diesel engines will ensure this is the case. In the past, the Agency has relied on the defeat device prohibition in addition to the FTP to ensure the emission reductions predicted by the standards are met during actual in-use operation. The defeat device prohibition is designed to ensure that emissions controls are employed during real world operation and not just under laboratory or test procedure conditions. However, the defeat device prohibition is not a quantified numerical standard and does not have an associated test procedure. As a result, the defeat device prohibition is an imprecise tool to ensure that engines will operate with the same level of control in the real world as in the test cell. Engine manufacturers in the past have substantially increased emissions during off-cycle operation. Such a situation could lead to protracted litigation and uncertainty, given the necessary lack of quantification in the defeat device prohibition, which decreases the certainty of the emission reductions and creates considerable burdens that are in no one's interest. Such imprecision could also delay certifications, because EPA and a manufacturer may disagree on whether an AECD is appropriate or EPA and the manufacturer may need to discuss in depth what type of AECD would be appropriate.

To ensure that emission standards are providing the intended benefits in use, emissions under real world conditions must reflect those measured on the test procedure. The SSS and NTE for HD diesel engines are designed to supplement the current FTP standards and defeat device prohibition, and hence provide the emission benefits envisioned by the FTP standard. Given the past practices of engine manufacturers regarding the control of emissions off the FTP cycle, and the continuing contention of some manufacturers that such practices did not violate the preexisting law, it is clear that the supplemental requirements will, at least in the minds of these manufacturers, create a substantial emission benefit. Even if all manufacturers had been controlling for emissions over the broad range of in-use operations and ambient conditions, the supplemental requirements will be reinforcing the current FTP standards and putting specific limits on off-cycle emissions, which certainly carries with it emission benefits.

We disagree with the comments from GM/Isuzu that the supplemental requirements are not needed because of the HD consent decrees. The HD consent decrees apply to only part of the HDDE industry, and the consent decrees have provisions indicating that they are expected to expire in the future. In addition, not all CD companies must meet NTE requirements. Therefore, it is

possible that no HDDEs will be required under the consent decrees to meet NTE or SSS emission limits in model year 2007 or thereafter. Therefore, EPA must have supplemental requirements in place by model year 2007, the implementation year contained in this final rule, to ensure the long term continuation of these requirements.

Issue 8.6 Appropriateness of and Compliance with the Supplemental Requirements

COMMENT F: General Motors Corp. & Isuzu (GM/Isuzu) commented the proposed supplemental procedures are impermissibly subjective, and thus fail to provide fair notice of whether the Agency will consider a manufacturer to be in compliance. GM/Isuzu commented the proposed test procedures are arbitrary and subjective, and thus fail to provide manufacturers with sufficient ability to determine at the time of manufacture and distribution whether they will be determined later to be in compliance. GM/Isuzu commented the proposal to require NTE testing under "any conditions that could reasonably be expected to be seen by that engine in normal vehicle operation and use" (See 64 FR 58490), would give EPA inspectors complete and unlimited discretion when conducting testing. GM/Isuzu commented the proposed 30 second averaging time "makes matters worse". GM/Isuzu comment the proposed supplemental standards are subjective, would create wide variability in testing results, and would be both impracticable and unpredictable. GM/Isuzu commented that the adoption of a modified Euro-III cycle departs from the Agency's past practice of defining an objective emission standard and utilizing standardized test methods to determine compliance with the standard. GM/Isuzu commented the proposal contains undefined compliance conditions which will impose obligations on the manufacturers which are effectively limitless in their scope. GM/Isuzu commented that by making a compliance determination based on emissions during any 30-second window of on-highway operation, the Agency is dictating a virtually unlimited set of potential test conditions.

GM/Isuzu also provided a long and detailed discussion of the use of on-road emission measurement equipment. GM/Isuzu commented that the us of on-road measurement equipment such as the real-time on-road emission reporter ("ROVER") are inadequate to determine compliance status accurately. GM/Isuzu comment that while EPA did not propose requiring ROVER systems in the proposal, the promulgation of standards which could apply during any 30-second period of operation implies the development of real time instruments similar to ROVER. GM/Isuzu comments that there are serious problems with ROVER-type systems which makes them inadequate for emission measurement and compliance purposes. GM/Isuzu comment these problems must be resolved before any such system is established as a regulatory compliance requirement. GM/Isuzu's comments go on to discuss three main issues regarding ROVER-type equipment; 1) equipment and procedure issues must be addressed before utilizing ROVER-type equipment for compliance determinations, 2) ROVER produces significant test-to-test variability and vehicle-to-vehicle variability, 3) ROVER results are not accurately correlated with the FTP. **(General Motors Corporation and Isuzu Motors America Incorporated (IV-D-65))**

RESPONSE: We disagree with these comments.

As discussed in the response to comment K under Issue 8.8, the Agency has provided specific ambient conditions and altitude provisions for the NTE, and has defined the specific engine speed and load boundaries covered by the NTE.

The SSS requirements apply to the exact same laboratory conditions applicable to the existing FTP for HDDE. The Maximum Allowable Emission Limits (MAEL) apply to specific steady-state speed and load conditions defined by speed and load boundaries specified in the regulations.

The MAEL procedure defines the specific interpolation method which must be used to calculate the limit values, and the test defines the specific speed and load points that bound the control area in which EPA may select the three supplemental test points ("mystery points"). Therefore, the supplemental requirements are not subjective at all, but are specifically defined by numerical boundaries. Manufacturers will know precisely what conditions they are required to comply with to meet the supplemental standards. GM/Isuzu comment that the proposed test procedures are subjective. However, the SSS specifies an exact, laboratory based test procedure which will be used to determine if an engine is in compliance. The NTE requirements do not allow EPA to test compliance at any condition operated by an engine. The NTE regulations specify specific engine operating zones under which testing can be compared to the standard, for time durations as short as 30 seconds; however, longer sampling times are included.

GM/Isuzu point to the phrase "any conditions that could reasonably be expected to be seen by that engine in normal vehicle operation and use" which was contained in the preamble to the proposal, to support their comment that the NTE requirements are subjective. The regulatory requirement contained in this final rule specifies that an engine must comply with the NTE "under conditions which can reasonably be expected to be encountered in normal vehicle operation and use.", see § 86.1370-2007(a), which is a limitation on EPA's authority to test outside of those conditions. The statement regarding normal vehicle operation and use is virtually identical to the existing regulatory definition of defeat device which both the on-highway light duty vehicle and heavy-duty engine industry have been regulated under for many years. The existing applicable definition of defeat device for on-highway HD engines specified in § 86.094-2 states (underline added for emphasis);

> *Defeat device means an auxiliary emission control device (AECD) that reduces the effectiveness of the emission control system <u>under conditions which may reasonably be expected to be encountered in normal vehicle operation and use</u>, unless:*
> *(1) Such conditions are substantially included in the applicable Federal emission test procedure;*
> *(2) The need for the AECD is justified in terms of protecting the vehicle against damage or accident; or*
> *(3) The AECD does not go beyond the requirements of engine starting.*

The NTE provisions contained in today's final rule require engine manufacturers to design and control emissions below a specified maximum for the type of engine operation their product will encounter during normal vehicle operation and use. This is wholly consistent with past Agency requirements. Engine manufacturers such as General Motors will be able to rely on their more than 20 years of experience in designing engines which utilized AECDs which operate under conditions which may reasonably be expected to be encountered in normal vehicle operation and use as they develop engines to comply with the supplemental standards by model year 2007.

EPA believes that manufacturers have for years and will continue to routinely evaluate their engines to ensure that their products provide a high level of performance and reliability for non-emissions related qualities during normal vehicle operation and use. The highly competitive nature of this market and its sophisticated consumer base call for such analysis by manufacturers. EPA expects that this same knowledge of how their engines are normally used and operated can be employed by manufacturers in designing for emissions performance as well as non-emissions related performance.

EPA's use of the term normal vehicle operation and use is designed to build on such current industry practices. It is not designed to address rare, unique, or abnormal operation and use, but instead focuses on what is commonly and generally viewed as normal driving and operation during urban, suburban, and interstate driving. This would not include abusive, reckless, unlawful, or unsafe driving or operation. It is aimed at the kind of operation and use that is encompassed in section 207(c)'s limitation of recall authority to proper operation and use.

The kinds of operation and use envisioned by the current definition of a defeat device and the statutory provision for recall have been employed by the agency and industry to regulate in-use emissions for over two decades. Manufacturers have also designed for in-use performance of non-emissions qualities for many years. The term "normal operation and use" in the NTE test procedure is directed at the same kind of limits on operation and use employed in these other contexts. Any subjectivity in the term "normal operation and use" is no greater in the context of the NTE than in these other contexts. The experience in the last decades in implementing these other provisions indicates that use of the same provision in the NTE requirements provides a reasonable basis for all parties to design complying engines under this provision.

Moreover, because manufacturer requirements under the supplemental procedures are specifically linked to particular numerical emission values, these requirements are significantly less subjective than the previous regulatory regime. Manufacturers will know that if emissions from their engines are below a specific number under specified engine and ambient conditions, they will meet the supplemental requirements. It is only if a manufacturer cannot meet this specific number under those conditions that the term "normal operation and use" is even implicated.

Regarding GM/Isuzu's comments on measurement issues and compliance determinations, we did not propose a manufacturer-run in-use testing program and this final rule does not contain a manufacturer-run in-use testing program. See the response to the comments under Issue 27. We did not propose, nor did our proposal discuss, the use of the real-time on-road emission reporter (ROVER). We do not agree or disagree with GM/Isuzu's detailed comments which are specific to the ROVER system. Our proposal did not describe the ROVER system and this rulemaking does not rely on any data generated by the ROVER system. Therefore we will not respond to GM/Isuzu's specific comments on the ROVER system in this rulemaking.

GM/Isuzu's broader comments on compliance testing are clearly relevant to this final rule action. GM/Isuzu's comments imply that the Agency would make compliance determinations based on arbitrary and subjective test data. As discussed above, the test procedures and equipment used to determine compliance with the SSS, MAEL, and "mystery points" is the same equipment and procedures used for the existing FTP, which are not arbitrary or subjective. The NTE procedure specifies the conditions under which the engine must comply with the NTE standard. We have not specified the emission measurement equipment which could be used to determine compliance with the NTE, and we do not believe it is necessary to do so. However, this does not give the Agency unlimited discretion to determine compliance with the NTE as suggested by the commenters. Compliance with the NTE could clearly be determined using the laboratory equipment and procedures specified in the regulations for the existing FTP. The test equipment regulations for the existing FTP include detailed accuracy and precision requirements for the equipment, which allows manufacturers to design their engines with sufficient compliance margins to ensure that the true value (i.e., the actual value) of the engines emission performance is below the emission standard, including appropriate consideration for the accuracy and precision of the test equipment. The use of

existing standard laboratory equipment will allow manufacturers to design engines to comply with the NTE standard, because the use of existing laboratory equipment will allow manufacturers to design engines with sufficient compliance margins to ensure the true value of the engines emission performance is below the emission standard. Laboratory facilities with engine dynamometers are capable of simulating any duty cycle which the engine would experience during normal vehicle operation and use during actual on-road vehicle operation. In addition, as discussed by a number of engine manufacturers, the effect of temperature, humidity and altitude on HDDE engines are well known, and manufacturers can include appropriate compliance margins to design engines to comply with the broader range of expanded conditions which apply to the NTE based on their existing expertise and knowledge. A manufacturer can therefore design engines based on laboratory equipment which ensures that the true value of the engines emission performance is at or below the emission standard, and that engine would therefore continue to comply with the standard in actual vehicle operation during normal vehicle operation and use.

Test procedures and equipment for compliance testing for the NTE during on-road, in-vehicle driving have not been defined in this final rule. However, in the event the Agency does use in-use, on-road measurement equipment to determine HDDE compliance with the NTE, we would need to give appropriate consideration for measurement equipment accuracy and precision when considering the results of an in-use test program. EPA would need to show that the in-use on-road equipment it was using for such a determination is sufficiently accurate, and the tests sufficiently repeatable, to show that the engine was in fact violating the standard. Further, manufacturers have the right to an administrative process and would have the same right to challenge such EPA decisions as they do to challenge any other EPA final decisions. Since the EPA has not specified all of the test equipment and procedures in the regulations, the Agency would bear the burden of demonstrating that any decision regarding the NTE standard based on in-use, on the road measurement equipment was based on an accurate measurement of the engine's true NTE emission performance.

Regarding the use of selective enforcement audits and the supplemental standards, as discussed under the response to comment U under Issue 8.14, we have specifically removed NTE, MAEL, SSS "mystery point", and LRT testing from the selective enforcement audit regulations. This final rule only adds the SSS to the SEA regulations for HDDEs. The SSS is a pre-defined duty cycle, performed using the same laboratory equipment and under the same laboratory conditions applicable to the existing FTP, with a numerical standard equal to 1.0 times the existing FTP standard. Manufacturers have the same rights and responsibilities with respect to SEA testing of the SSS as they do with the existing FTP.

The Agency and the Engine Manufacturers Association have agreed to work on the issue of an in-use compliance program by manufacturers for HD engines and vehicles, and we expect to discuss in-use, on-road measurement methods as part of that discussion. In addition, as part of their requirements under their specific consent decrees, a number of heavy-duty diesel engine manufacturers are actively working on improved methods of in-use emissions measurement for HD diesel engines. Based in part on this future work, it appears reasonable that considerable improvement in existing on-road emission measurement equipment may occur in the near future. The fact that we have not codified at this time emission measurement equipment and procedures for in-use, on-road testing of the NTE emission standard does not preclude the Agency from doing so in the future. The Agency reserves the right to codify such regulations in the future, through a rulemaking process, as deemed appropriate.

We do not agree with GM/Isuzu's comment that the supplemental standards would create wide variability in testing results. As discussed above, compliance determinations with respect to the supplemental standards would be made based on the Agency showing that decisions based on emissions data rely on accurate emissions measurement. There is nothing inherent with the supplemental standards which would create any additional variability in testing results than exists today with the existing FTP. Manufacturers have historically accounted for the uncertainties in their measurement equipment by using a compliance margin to target emission levels so they are certain that their engines will comply with the standard. Manufacturers can continue to use their existing laboratory equipment with known uncertainties to develop appropriate compliance margins for the supplemental tests. It is not clear from GM/Isuzu's comment why they believe the supplemental standards would add additional variability, and we do not believe this is the case.

Issue 8.7 Use of Confidential Information During the Rulemaking Process

comment G: EMA commented that EPA's proposed 1.25 NTE factor is unfairly based upon confidential emission maps and confidential discussions with engine manufacturers. EMA specifically points to the discussion on page 38 of the proposed draft Regulatory Impact Analysis document. EMA states that the foundation on which EPA concluded that the 1.25 factor is feasible was the Agency's examination of individual engine manufacturers confidential emission maps. EMA states that this approach is fundamentally flawed, because it does not provide the ability for anyone in the public to critique the data, and therefore EPA has failed to allow for public participation in the rulemaking process as required by the Clean Air Act.

EMA provides an analysis of one public source of HD diesel data which they believe fails to demonstrate the feasibility of the NTE 1.25 emission limit.

DaimlerChrysler commented that the technical feasibility of the proposed supplemental requirements are unsupported, and EPA relies mainly on verbal assurance provided by some manufacturers during consent decree negotiations to establish feasibility. **(Engine Manufacturers Association (IV-D-05), DaimlerChrysler (IV-D-44))**

RESPONSE: We disagree with these comments in several respects. First, the two paragraphs worth of discussion on page 38 of the draft RIA which EMA refers to is not the "foundation" on which we have based our final decision that the NTE requirements are technologically feasible in the 2007 time frame. The draft RIA discusses emission maps specifically from 1998 technology HDDEs, but in this final rule we have discussed in detail the application of cooled EGR, advanced turbocharging systems, next generation electronically controlled fuel injection systems, and advanced electronic controls to 1998 technology HDDEs. In our proposal, and in this final rule, EPA has provided several detailed discussions of the technology which will enable manufacturers to achieve the NTE limits. The preamble and RIA for the proposal and this final rule describe in detail the technologies EPA expects manufacturers to use to achieve the NTE requirements by 2007. EPA has summarized and included citations to a large body of publically available scientific data and studies on the performance and emission impacts of cooled EGR, advanced second generation fuel injection systems, variable geometry turbochargers, just to name a few (see for example references in the RIA to the following SAE papers, 964112, 970340, 973182, 980174, 980190, 982679). This is just a partial list of the publically available data we relied on, all of which are either in the public docket for this rulemaking, or instructions on how to obtain the references are in the public docket for this rulemaking.

The data which EMA submitted to demonstrate the infeasibility of the proposed supplemental requirements was emissions data from a test program performed at SwRI for the sole purpose of evaluating the effects of various diesel fuel formulations over the existing transient FTP. The test cycle used for the program by SwRI was the so-called AVL 8-mode test procedure, which has been used in the past as a development tool for predicting NOx emissions over the transient FTP. The goals of this test program were not to demonstrate the feasibility or infeasibility of the NTE or the SSS. Therefore, it would be improper to use the data from this test program to claim the feasiblity or infeasibility of the SSS or NTE requirements. For example, the AVL 8-mode weights the idle mode by 35 percent in the composite result, but the NTE does not even cover idle emissions, and the SSS weights the idle emissions by only 15 percent. A number of the other modes covered by the AVL 8-mode do not even fall within either the NTE control zone or the SSS steady-state control zone, and are thus not even covered by the supplemental test requirements. In addition, the test engine used by SwRI did not utilize a number of the technologies the Agency believes would be used to comply with the final requirements, including VGT and second generation fuel injection with rate shaping ability. Therefore, we do not believe the data submitted by EMA is useful for the purpose of commenting on the technical feasiblity of the supplemental requirements.

EPA also relied, to some extent, on summaries of confidential business information presented by engine manufacturer and others. Non-CBI summaries of this information have been placed in the docket for this rulemaking and are available for public review. See also response to comments under Issues 8.8, 8.9, 8.10, and 8.11 regarding the technical feasibility of the supplemental requirements.

Issue 8.8 Not-to Exceed Requirements

Comment H: EMA commented that the proposed not-to-exceed (NTE) requirements are unsound and significantly increase the stringency of the standards which the manufacturers must comply with. EMA commented that EPA has failed to demonstrate the proposed NTE limits are technologically feasible. EMA commented that to the contrary, the data available indicates the NTE proposal is not feasible. To support this claim, EMA commented that the proposal to “flatten” emissions in the NTE zone increases the stringency and costs of meeting the emission standards with no emission benefit. EPA has failed to account for the inherent variations in brake-specific emissions of an engine’s operating range, which can be substantial. EMA claims that in order to comply with the NTE limits, emissions in higher emitting operating modes will need to be substantially reduced. This will require additional development and in many cases, additional technology. EMA claims that it is likely that operation in the higher emitting modes will likely be limited, therefore imposing costly methods to ensure they comply would be out of proportion with the real-world emission reductions which would be achieved. EMA claims this critical cost data is unknown because EPA did not perform the requisite analysis.

EMA commented that the proposed NTE was inappropriately developed based on “old” engine technology. EMA claims the NTE was developed, during the HD diesel Consent Decrees, based on manufacturers data and experience on 1998 HDDE technology. EMA states that EPA incorrectly assumes these NTE provisions can therefore be applied to future engine technologies with no impact on the technological feasibility of the proposed standards. EMA states EPA is incorrect for three reasons; (1) not all manufacturers signed Consent Decrees, (2) the ability of 2004 and later technology engines to comply with the NTE requirements set forth in the Consent Decrees is unknown and may not be feasible, and (3) Congress has placed the burden of demonstrating

feasibility and cost-effectiveness on EPA. EMA states that EPA has not met this burden. EMA states that EPA must determine the appropriate size and shape of the NTE zone, including the size and shape of "carve-out" zones, and the appropriate multiplier based on the characteristics of technologies that will be used to meet the applicable emission standards. EMA states that NTE zone size, shape, carve-outs, and multiplier were all based on 1998 technology engines. EMA states that the technologies used to meet the 2004 standards will be quite different. As an example, EMA discusses the use of retarded injection timing as a 1998 technology, and EGR as a 2004 technology. EMA's example discusses the difficulty of forcing EGR flow rates under higher load conditions due to the pressure differential between the intake and exhaust, while retarded timing as a control technology becomes more viable with increasing engine load. EMA states that engine emission maps, NTE zones, and emission carve-outs applicable to 1998 technology are not representative and fairly applicable to 2004 engine technology. EMA states that the information EPA has relied on to develop the NTE proposal is not applicable to 2004 technology engines. EPA must determine the appropriate NTE requirements based on adequate data. Until EPA has done so, EPA should not finalize the NTE zone, the NTE carve-outs, or the NTE 1.25 limit.

Mack Truck commented that the NTE proposal is not technically feasible for HDDE at the 2004 standard level. Mack claims EPA has failed to consider the inherent variability in brake-specific emissions of an engines operating range. Mack commented that while they meet an NTE limit on engines certified by EPA today (as a result of its consent decree), that level is 3 g/bhp-hr of NOx above today's 4 g/bhp-hr NOx standard. Mack suggests that the proposed NTE level of 1.25 times the 2004 standard, which is only 0.625 g/bhp-hr above the FTP standard, cannot be achieved based on their currently available data. Mack comments that the main technical issues are at low speed (engine rotational speed), high load operating conditions. Mack comments that this is the region where HD diesel engines have little air/fuel ratio headroom, and forcing EGR under these conditions leads to high PM levels, as well as pushing current generation turbochargers to their limits. Mack suggests that EPA must provide relief on the proposed 1.25 NTE limit, at least for the low speed, high load regions of the NTE control zone. Mack suggests that operating points within the NTE control zone with engine speeds less than the SSS "B" speed, and loads greater than 75 percent should be exempt from the proposed 1.25 NTE multiplier.

Detroit Diesel Corporation commented that EPA should provide justification for the NTE. DDC commented that manufacturers will need to expend signifcant resources, and potentially develop new technology to meet the NTE requirements in the higher emitting regions of the NTE control zone. DDC comments that if these conditions are only encountered rarely the resulting costs would be out of proportion to the benefit. DDC also commented that EPA must show that the NTE control zone and the 1.25 factor are technologically feasible. DDC commented that EPA has not provided data to demonstrate the feasibility of the 1.25 factor for an NMHC+NOx standard of 2.5g/bhp-hr, and DDC knows of no such data.

Navistar International Transportation Corp. (Navistar), supported a number of the comments listed above. In addition, Navistar commented that the NTE places an absolute cap on an engine's emissions of 1.25 times the 2004 model year FTP standards and Navistar is not aware of any technology which is anticipated to be available by MY2004 which would enable a manufacturer to meet a 2.5 g/bhp-hr NMHC+NOx FTP level and an NTE level of 1.25 times that standard, therefore the manufacturer will need to target an FTP level significantly below the 2.5 g/bhp-hr NMHC+NOx FTP standard. Navistar also commented that the proposed carve-out zones for PM are too narrow to make any significant difference, and EPA did not solicit or incorporate any information from

Navistar related to Navistar's light- and medium-heavy duty engine applications in the development of the proposed NTE and associated carve-outs.

DaimlerChrysler supported a number of the comments listed above. In addition, DaimlerChrysler commented that the proposed NTE requirements require major development efforts for certain engine operating modes without providing any quantifiable environmental benefits compared to the FTP standards. DaimlerChrysler comments that manufacturers must design engines to meet emission standards and be fuel efficient. DaimlerChrysler (DC) comments that these dual requirements imply that relatively high brake specific emissions may occur at some low load and low speed operating modes outside the typical engines operating range. DC comments that designing engines to meet emission standards under any conceivable operating conditions ignores the foregoing dual requirements, and likely increases CO2 emissions which EPA has failed to consider and will increase the financial burden to the trucking industry which EPA has failed to address. DC also commented the total emissions output generated during operation should be of primary concern, not the emissions during a single moment at a specific operating point. DC commented the emissions of concern are those generated during normal operations averaged over a reasonable length of time. DC states manufacturers can anticipate normal operations over a reasonable length of time, but not all temporary conditions of engine operation. DC commented that conditions may occur where emissions are higher than the standard, even though the engine's overall emissions are below the standard. As examples DC comments that such conditions may include "operation while heavily loaded, during acceleration up a hill, operating under extremely cold or hot ambient temperatures, operation at high elevation or traveling into a strong head wind." The proposed NTE would increase dramatically the burden on manufacturers with little or no environmental benefit. DC comments that the record does not contain any engineering or scientific data to support the proposed NTE control area or limits. DC commented that while they have not had the necessary time to run a test program in order to establish engine maps with 60 load-points or more for evaluation of the NTE, they have run a HD diesel engine over the NTE control area at approximately 20 load-points. Based on this testing, DC believes NTE compliance for NOx cannot be readily obtained for a number of load-points, except through extremely high fuel consumption. No test data, test program description, or any additional information regarding the test program were provided. DC comments that without data correlating the NTE limits to the FTP transient test procedure or actual driving, the stringency of the NTE limits cannot be assessed properly and their technical feasibility remains unproven. DC comments that the proposed NTE represents an undue increase in stringency over the proposed limits. DC recommends EPA withdraw the proposed NTE from the final rule, and, at the most, finalize the additional steady-state Euro III procedure as proposed by EPA.

General Motors Corp. & Isuzu Motors America Inc. (GM/Isuzu) supported a number of the comments listed above. In addition, GM/Isuzu commented the NTE limits are infeasible, unnecessary, and cost-ineffective. To support these statements, GM/Isuzu include a detailed discussion of the inappropriateness of the NTE requirements for HD gasoline engines, including comments and discussion on an NTE control zone other than that which was proposed, and including a discussion of data collected by GM/Isuzu on HD gasoline engine(s). GM/Isuzu comment that to the best of their knowledge, EPA has not set forth test data which supports the proposed NTE limits. GM/Isuzu comment that EPA has not provided data showing how the NTE correlates to the existing FTP, and without such data it is not clear how stringent the NTE is, or if it is feasible. GM/Isuzu comment the NTE test represents a technically unsound and inefficient emission control approach. GM/Isuzu commented it is the aggregate emissions that are of concern

and therefore those which are generated during normal operations average over a reasonable length of time. GM/Isuzu comment that from an environmental standpoint it is these aggregate emissions that are of concern, not the emissions from a single moment of operation. GM/Isuzu commented the NTE restricts emissions at every engine operating point, which prevents manufacturers from using available calibration strategies to reduce overall emissions. GM/Isuzu comment that this approach is analogous to a situation where no averaging, banking and trading program is allowed between engine families. The NTE therefore has the effect of not allowing for more cost-effective reductions, therefore the proposal to eliminate isolated exceedances through an NTE cap would be cost-ineffective to the point of being counter-productive, and would be contrary to law and inconsistent with decision making requirements of the Clean Air Act. GM/Isuzu commented the proposed NTE limits are not appropriate to gasoline engines that rely on aftertreatment, and the proposed NTE limits to not appear to recognize the importance of protection enrichment.

The New York State Dept. of Environmental Conservation (NYS-DEC) commented the proposed NTE control zone does not address engine operating speeds below 1,100 rpm, based on the figures contained in the Agency's proposal. NYS-DEC commented they are concerned the proposed NTE would provide engine manufacturers incentive to redesign current engine and transmission configurations towards low speed, high torque operation in order to avoid compliance with the NTE standard.

(Engine Manufacturers Association (IV-D-05), Mack Truck Inc. (IV-D-06), Detroit Diesel Corporation (IV-D-28), Navistar International Transportation Corp. (IV-D-29), New York State Dept. of Environmental Conservation (IV-D-41), DaimlerChrysler (IV-D-44), **General Motors Corporation and Isuzu Motors America Incorporated (IV-D-65))**

RESPONSE: We disagree with these comments. The information available to date, discussed below, indicates that manufacturers have already demonstrated that the NTE requirements are achievable over greater than 90 percent of the NTE control zone, for a broad range of ambient temperature and altitude conditions. EPA is making minor changes to the NTE requirements as compared to the NPRM, to reflect certain areas where the technological challenge is more difficult. In general, the overall structure of the NTE requirements remains unchanged. The most significant change from the proposal to the final rule for the NTE is the model year implementation. We proposed to implement the NTE requirements in model year 2004, but as discussed in the preamble for this final rule, we have finalized the NTE requirements for HDDEs with a model year 2007 implementation. As discussed below, considering the capabilities of the technology anticipated to be used by HD diesel engine manufacturers to meet the 2004 FTP standards, the current status of a number of manufacturers efforts to achieve similar NTE limits as contained in the FRM by 2002, and the nearly 7 years of lead time, the Agency is convinced that the NTE requirements finalized in this rule will be technologically feasible by model year 2007.

Aspects of the NTE Requirements Which Can Be Met Today

We disagree with the comments which suggest the NTE limit of 1.25 times the FTP standard is not technologically feasible by model year 2007. After the publication of our proposal, we met with a number of individual HD diesel engine manufacturers as well as the Engine Manufacturers Association in total more than two dozen times to gain additional information and knowledge regarding the manufacturers' technical concerns with the proposed supplemental requirements, and

most specifically the proposed NTE requirements. These meetings are summarized in memorandums which have been placed in the public docket for this rulemaking. In addition, on a number of occasions individual companies provided the Agency with confidential business information regarding their ability to comply with the proposed supplemental standards. An EPA memorandum summarizing this information in a non-confidential format is available for review in the public docket for this rule (EPA Air Docket A-98-32)[4]. The material received by EPA indicates a number of manufacturers are capable of complying with the proposed NTE requirements for NMHC+NOx and PM today (i.e., 1.25 x 2.5 g/bhp-hr NMHC+NOx and 1.25 x 0.1 g/bhp-hr PM) across a broad region of the NTE control zone, and under a broad range of operating conditions for a large portion of their HD engine product line. Manufacturers have achieved this degree of compliance with the NTE principally through the application of cooled EGR, advanced turbocharging systems (either variable geometry turbocharging or two-stage turbocharging), and high pressure electronically controlled fuel injection systems (either unit injectors or common-rail systems). A number of manufacturers have demonstrated the NTE are achievable over greater than 90 percent of the NTE control zone, for ambient conditions between 55 deg. F to at least 90 deg. F at sea level and at least 70 deg. F at 5,500 feet above sea level. This is the case because the emission control technology discussed above (cooled EGR, advanced turbomachinery, next generation electronic fuel injection systems, and advanced electronic controls) which can and likely will be used to comply with the existing 2004 FTP standard and the 2007 SSS standard have been shown to reduce emissions of NOx and PM over the vast majority of the NTE control zone. In many areas of the engine map the existing FTP and the SSS overlap with the NTE control zone, and in these areas of the map the strategies used to meet the existing FTP and the SSS provide emission reductions which are more than sufficient to comply with the NTE requirements. In general, the lower power rated engines are capable today of achieving NTE compliance across a broader region of the NTE control zone and at a broader range of ambient temperatures and altitudes than higher power rated engine models. In general, this is because the higher power rated engine models are pushing the limits of current generation turbomachinery near their material limits today, and compliance with the NTE will place additional stress on these limits, as discussed in more detail below. As discussed below, a number of technical issues remain which must be solved, and we believe will be solved, before compliance with the NTE over the entire NTE control zone and the entire range of ambient conditions for which the NTE applies can be achieved for the range of HD engine service class and ratings which manufacturers produce. The NTE is therefore a technology-forcing standard to some extent. However, the evidence indicates that the technology will be available, as discussed below, to meet the NTE standards by the 2007 model year.

Aspects of the NTE Which Present Technical Challenges, but Which Can Be Overcome

Manufacturers have articulated a number of technical issues which must be overcome in order for NTE compliance to be achievable across all HD service classes for the entire NTE zone and for the expanded temperature and altitude conditions. These issues were described in a number of the written comments summarized above, as well as in the individual and industry meetings with EPA after the close of the comment period. In general, the issues fall into four categories;

– Compliance with the NTE due to the “inherent” variability of HDDEs emission maps and the

[4] See EPA Memorandum to the Docket “Summary of CBI information regarding proposed HD Supplemental Test Requirements”.

"flat" map requirement of the NTE
- Compliance with NTE During High Load Engine Operation
- Compliance Problems with NTE Due to Condensation and Corrosion Issues
- Compliance Problems with NTE PM Standard Due to the Use of Aftertreatment and the Formation of Sulfate
- Compliance Problems with NTE Under Conditions of High Altitude and/or High Temperature

These issues are discussed in detail below, with the last issue discussed in response to Comment K of this issue.

NTE and the "inherent" Variability of HDDEs Emission Maps

The comments that EPA has failed to account for the "inherent" un-evenness of HD engines brake-specific emissions in the NTE control zone do not appear to be relevant given the capability of both current technology diesel engines, and the emission reduction capability of the technologies anticipated to be used to meet the 2004 standards and the 2007 standards, including the NTE. With the use of controllable engine parameters such as injection timing, injection pressure, injection rate shaping, EGR rate, and controllable turbochargers (e.g., VGTs), engine manufacturers have an enormous number of subsystems which they can and must control to meet emissions and performance objectives. The term "inherent" does not appear to apply to the emission performance of 2004 technology HD diesel engines because the engines emission performance is dictated by the technology and control system approach the manufacturer chooses, and hence there is not a natural or "inherent" un-evenness for the Agency to consider in setting the NTE emission requirements. Instead, the Agency must consider what the capabilities of the technology are. That is what we have done in this final rule.

Engine manufacturers have also commented the NTE requires a flat emissions map, which some commenters suggest is not feasible for a 2004 technology engine. The NTE requirements do not require a flat emissions map, as suggested by the commenters. The NTE requires that no pollutant can be above 1.25 times the FTP standard under the specified NTE conditions. The NTE represents a cap on the emissions, and not a requirement that emissions be flat across the NTE control zone. Just as emissions from the individual SSS modes and points on the preexisting FTP test can be above and below the FTP standard level and do not have to be "flat", as long as the average meets the FTP standard, we expect that many areas within the NTE control zone will be well below the NTE standard and the emission map will not be flat.

Compliance with NTE During High Load Engine Operation

A number of the commenters suggested the NTE standards are not achievable during operation in specific regions of the NTE control zone, specifically the high load operation covered by the upper region of the NTE control zone. See also the summary of the CBI data EPA received from manufacturers regarding the supplemental standards.[5] In the upper torque region of the map, a number of technical issues must be overcome. In order to lower the NOx emissions to meet the NTE requirements, EGR must be used. In the higher torque region of the NTE control zone, a

[5] See EPA Memorandum to the Docket "Summary of CBI information regarding proposed HD Supplemental Test Requirements".

HDDE's intake system is at higher pressure then the exhaust system, so a sufficient pressure differential must be developed in order for the exhaust gas to be forced into the intake system during high load operation. This issue is discussed in detail in Chapter 3 of the RIA. As discussed in Chapter 3 of the RIA, variable geometry turbochargers allow sufficient back pressures to be generated during high load operation to force EGR. During high load operation, the HDDE's air-fuel ratio is at it's lowest, typically in the 19 - 21 air/fuel ratio number range. As air-fuel ratio drops, PM can become a problem. EGR has the effect of lowering air-fuel ratio, because the recirculated exhaust gas contains less oxygen. In order to compensate for the mass of fresh air displaced by the EGR, engine manufacturers must achieve a higher pressure ratio.[6] To run at higher pressure ratios, the turbocharger must compress more intake air. For modern HD on-highway diesel engines which are highly rated (i.e., high horsepower ratings for a given engine displacement), turbomachinery (turbine plus compressor) operates close to a number of design limits in the upper regions of the NTE control zone. These design limits can be turbocharger rotational speed limits, or turbocharger compressor maximum temperature limits. In addition, due to the low air/fuel ratio near peak torque, accurate control of EGR rate is critical. In order to control EGR rate, a variety of sensors can be used to monitor the EGR system, including in some cases mass air-flow meters, oxygen sensors, NOx sensors, and VGT vane position control. Manufacturers have expressed concerns that the accuracy and durability of these sensors in the 2004 time frame may not be sufficient to control the EGR flow rate to the degree necessary, in particular in the high load region of the NTE control zone.

We have identified a number of improvements in current generation hardware which will allow engine manufacturers to overcome these issues. It is important to note that engine manufacturers who commented on the technological feasibility of the NTE requirements were commenting with respect to a model year 2004 implementation, and in some cases a model year 2002 implementation. In this final rule we are establishing NTE standards for model year 2007, which provides almost 7 full model years of lead time. Manufacturers have expressed concerns with the thermal and mechanical limits on turbomachinery in the 2002-2004 time frame. The Agency has discussed these issues with one manufacturer of HD diesel turbochargers.[7] The turbocharger manufacturer stated based on their experience the NTE requirements could be met in the 2004 time frame with the use of EGR and a single-stage variable geometry turbocharger. The turbocharger manufacturer believed the NTE requirements could be achieved with pressure ratios of 3.5 for standard conditions at sea-level, and this pressure ratio should allow the engine to meet the NTE requirements at 5,500 feet above sea-level and 95 deg. F. However, the turbocharger manufacturer indicated this would be near the temperature limits of the turbocharger's compressor, which is approximately 400 deg. F. In the event the turbocharger's temperature limit was compromised, a number of alternative methods could solve the issue. These include the use of a titanum alloy for the compressor, which has much higher thermal stability, combined with the use of a pre-cooler to lower the gas temperature prior to the aftercooler, which is also made of aluminum. A second alternative suggested by the turbocharger manufacturer was two-stage turbocharging with an intercooler, which would maintain the intake gas temperature within the temperature limits of the turbomachinery, as well as lower the rotational speed of the turbine wheel to maintain it within

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[6] Pressure ratio is the ratio of the pressure in the intake manifold (after the turbocharger) to the ambient air pressure ($P_{intake} \div P_{ambient}$).

[7] See EPA Memorandum to Air Docket A-98-32, meeting with Honeywell Turbocharger Systems, December 22, 1999.

acceptable speed limits. The Agency also believes that either of these two alternatives would overcome the turbomachinery issues raised by the engine manufacturers in the high-load region of the NTE control zone. In addition, we also believe modest improvements in current generation turbochargers will occur between now and 2007 which may eliminate the need to look at alternative material selection (e.g., titanum alloys) and the use of two-stage turbocharging. For example, current turbocharger compressor wheels are made of cast aluminum. It may be desirable for manufacturers to consider forged aluminum, which would be marginally stronger, and may provide the additional material strength necessary to achieve acceptable durability regarding compressor overheat and overspeed concerns. A second example would be boreless compressor wheels. Current generation compressor wheels typically have a hole (or bore) through them, and this is one of the most common regions for high rotational speed stresses to create fractures and lead to failure, e.g., the current through-hole designs limit the maximum rotational speed of the compressor. A boreless compressor wheel does not have a through-hole, and hence extends the over-speed limit of the turbocharger. Boreless compressor wheels are available from at least one HDDE turbocharger manufacturer.[8]

The second issue regarding the NTE feasibility issues in the high-load region of the NTE control zone manufacturers raised were controllability issues. Manufacturers commented that current generation control systems (actuators and sensors), were not sufficient to control EGR flow rates to the extent necessary in the high-load region of the NTE control zone. In this area, where air-fuel ratios are already low, the use of too much EGR can cause excessive PM, and the use of too little EGR will cause excessive NOx, and the operating window for control of both pollutants is narrow. We believe recent developments in variable geometry turbocharger (VGT) actuator control technology and recent developments in NOx sensors will allow manufacturers to overcome these control issues. Our discussions with a heavy-duty VGT manufacturer show that they have recently developed an electrically controlled VGT system which is an alternative to the currently available hydraulically or pneumatically controlled VGT which will have approximately the same cost.[9,10] The VGT manufacturers indicated the current generation hydraulic and pneumatic VGT systems have high hysterisis and poor repeatability, particularly at the extreme control settings that would be typical of the VGT control points in the high load region of the NTE control zone. The VGT manufacturer produces electrically controlled VGT systems for the light-duty market, and they are now developing a HD diesel specific VGT with an electric actuator which has significant improvements in control over the existing actuators. The VGT manufacturer believes this new, electrically controlled VGT will be production ready by 2002, and they suggest it should allow the precise control of EGR and airflow required to meet the NTE and expanded ambient condition requirements, because it does not have the same hysterisis and repeatability problems associated with current HD hydraulically or pneumatically systems.

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[8] See EPA Air Docket A-98-32, “Product Information from Garrett (now Honeywell Turbocharger Systems) regarding Recent Turbocharger, EGR and VGT Developments for the Heavy-duty Market”.

[9] See EPA Memorandum to Air Docket A-98-32, meeting with Honeywell Turbocharger Systems, December 22, 1999.

[10] See EPA Air Docket A-98-32, “Product Information from Garrett (now Honeywell Turbocharger Systems) regarding Recent Turbocharger, EGR and VGT Developments for the Heavy-duty Market”.

In addition to VGT control issues, HD diesel engine manufacturers have pointed to the lack of sensors with sufficient accuracy necessary to target the appropriate amount of EGR. Manufacturer have suggested currently available mass air flow sensors do not have the necessary accuracy, and oxygen and/or NOx sensors may not be commercially viable in the 2002 to 2004 time frame. Based on recent developments in NOx sensors, the Agency believes that NOx sensors will be available in the 2007 time frame. In the past few years, a number of technical papers have been published regarding the development of on-board NOx sensors.[11] The most recent of these papers, published by the Society of Automotive Engineers, paper number 1999-01-0202, describes a combination oxygen-NOx sensor which could be used for closed loop control of a diesel engine, and should be available prior to the 2004 model year.

Based on the above discussion, the Agency believes the NTE feasibility issues raised by the engine manufacturers with respect to engine operation in the high-load region of the NTE control area can be solved by model year 2007.

Compliance Problems with NTE Due to Condensation and Corrosion Issues

A number of manufacturers commented the NTE was not feasible for the full useful life of HDDEs. Specifically, manufacturers commented that because the proposed NTE standards would require the use of EGR during a wide range of ambient operating conditions, under specific conditions EGR would cause engine durability issues which would lower the useful life of the engine. This issue is discussed in detail in Chapter 3(II)(B) of the RIA for this final rule, and will only be summarized here. The recirculated exhaust gas contains large amounts of water vapor as well as SO2 as the products of combustion. If this water condenses in the intake system it can lead to sulfuric acid formation (H2SO4), which can corrode certain intake system and cylinder kit components, such as those made from aluminum. In addition, the condensation of large amounts of water vapor in the intake system, regardless of the presence of SO2, can also corrode the intake system and cylinder kit components. In our proposal, we discussed that manufacturers would use corrosive resistant EGR and intake system materials, and manufacturers would specify high strength bonding processes for EGR cooler manufacturing. In addition, manufacturers will use engine coolant for EGR coolant medium which is typically between 80 and 90 deg. Celsius in order to avoid cooling the EGR below the exhaust gases water vapor dew point which can lead to water condensation, which would allow the use of EGR over a wide range of operating conditions. In a number of discussions which occurred after the publication of the proposal, engine manufacturers described certain specific engine operating conditions which occur during normal vehicle operation which would still lead to water condensation regardless of the use of engine coolant as the EGR cooling medium, and thus could still cause engine durability concerns. The manufacturers described two situations which could lead to significant water condensation, both of which occur during cooler ambient operating conditions.

First, during cold ambient operation, the engine coolant temperature may take a long time to come up to the thermostat temperature (80-90 deg. Celsius), or, depending on the vehicle operation and the ambient temperature, it could cycle in and out of the thermostatically controlled temperature. During this type of operation, the EGR coolant temperature could be well below the exhaust water vapor dew point, and significant water condensation can occur in the intake system.

[11] See Society of Automotive Engineers paper: SAE 1999-01-0202; SAE 980170; SAE 970858; and SAE 960334.

Second, during cold ambient operation, even after the engine coolant temperature has stabilized at the thermostatically controlled operating range, under certain vehicle operation the intake manifold gas temperature can be sufficiently cold to drop the intake charge (EGR plus intake air) temperature below the water vapor dew point and cause significant water condensation. This can occur for example during low power operation when the air-to-air aftercooler over-cools the intake charge, such as during a sustained downhill coast.

To address these concerns, we have added a NTE Cold Temperature Operating Exclusion to the regulations for this final rule, see §86.007(a)(4)(iii)-2007 and §86.1370(f)-2007. During these conditions, the engine is not subject to the NTE emission standards. The regulations specify two types of operating conditions, an engine coolant temperature condition and an intake manifold temperature condition. When either of these conditions are met, the opportunity for significant water condensation in the engine's intake system exists, and therefore the manufacturer has access to the NTE Cold Temperature Operating Exclusion. These operating conditions were discussed with the Engine Manufacturers Association during a meeting with the Agency on February 24, 2000, and there was general agreement from the engine manufacturers that relief from the NTE during these types of cold operating conditions was necessary for HDDEs equipped with cooled EGR.[12]

We believe that the NTE Cold Temperature Operating Exclusion, in combination with the use of proper material selection and design of the EGR cooler, as well as the use of corrosive resistant materials on key intake system components, the NTE requirements can be achieved for the full useful life of HDDEs.

Compliance Problems with NTE PM Standard Due to the Use of Aftertreatment and the Formation of Sulfate

A number of manufacturers raised concerns with the NTE requirements for diesel engines using aftertreatment devices. Specifically, manufacturers were concerned the PM NTE standard could not be met with the use of diesel oxidation catalysts (DOC). Manufacturers were concerned that certain diesel oxidation catalysts formulations could generate high levels of particulate sulfate during certain engine operating conditions because of the high levels of sulfur contained in diesel fuel. During sustained high load operation, high exhaust gas temperatures could be high enough that some DOC formulations would increase PM, potentially above the NTE standard.

While we agree that some DOC formulations are active enough to result in an increase in PM levels during some operating conditions, we do not agree that this would make the NTE PM standard infeasible. For example, in the comments on this rulemaking submitted by the Manufacturers of Emission Control Associations (MECA, Docket Item #IV-D-38), MECA includes a test of a DOC formulation over a variety of steady-state modes using a fuel sulfur level typical of today's on-highway fuel (see Figure 5 in the MECA comments). Of the 13 modes tested, the particular DOC tested decreased PM for each mode except for one, which was a 100 percent load at 840 rpm test point. This mode point is outside of the NTE PM control zone for this engine. Regardless, the DOC increased the PM for this operating point from approximately 0.026 to 0.03 g/bhp-hr, or approximately 15 percent. Under this final rule, the NTE PM standard is 0.125 g/bhp-hr

[12] See EPA Memo to the docket regarding meeting between the Engine Manufacturers Association, the California Air Resources Board, and EPA on February 24, 2000

(0.0625 g/bhp-hr for urban buses, and this was not an urban bus engine). Therefore this steady-state test point was well below the NTE PM standard. In addition, the exact formulation of a DOC is chosen by the engine manufacturer, and thus the manufacturer has control over the extent to which the DOC is to active and can result in PM sulfate make. For example, in the comments submitted by MECA (Docket Item # IV-D-38), in Figure 1 MECA reports FTP PM levels for six different DOCs, each of which resulted in a different PM level, which is at least partially a result of the different formulations used on each DOC.

Therefore, the Agency does not agree that the NTE PM standard is infeasible because of sulfate formation from DOCs; while certain engine operation which increases PM may occur, in some cases these increases would occur during engine operation not covered by the NTE PM control zone, or, more importantly, such operation would not increase the PM level above the NTE PM standard. Finally, the DOC precious metal formulation is controlled by the engine manufacturer, so a manufacturer may need to carefully select catalysts formulations in order to avoid certain DOC formulations which are extremely active and could lead to excessive PM sulfate formation.

NTE Deficiency Provision

As discussed above, the Agency has considered the NTE technical feasibility issues raised by commenters, and we have made a number of changes in this final rule to address those concerns (e.g., model year 2007 implementation, NTE Cold Temperature Operating Exclusion discussed above, and the narrower range of NTE ambient conditions as discussed in response to comment K under this issue). However, we recognize that the NTE requirements are a new regulatory provision HDDE manufacturers have not been required to meet in the past. The NTE standards will require compliance over a wide range of engine operating conditions. Given the complexity of designing, producing, and installing the components and systems that are needed to comply with the emission standards, we are finalizing a temporary “NTE deficiency provision” in this action because we believe that, despite the best efforts of manufacturers, for the first few model years it is possible some manufacturers may have technical problems that are limited in nature but can not be remedied in time to meet production schedules. This NTE deficiency provision will allow the Agency to accept a HDDE as compliant with the NTE standards even though some specific requirements are not fully met. This approach is similar to the deficiency provision in the current on-board diagnostics regulations for light duty vehicles. As discussed elsewhere in this Issue 8, manufacturers have identified a number of technical issues which they anticipate manufacturers having difficulties overcoming. These include the availability of sensors and actuators with the necessary accuracy and repeatability to control engine and emission control hardware to the degree necessary to meet the NTE requirements under high load conditions during elevated temperatures and altitudes. Another example raised by some engine manufacturers was concerns with the limitation of current generation turbochargers, including compressor exit temperature limits and turbine wheel speed limits. While EPA projects that improvements in sensors, actuators and turbocharger materials, will reduce these limitations in the future, manufacturers are concerned improvements may not be sufficient or may not occur early enough to allow the NTE requirements to be met for all engine families under certain operating conditions by 2007. The NTE deficiency provision will provide additional lead time to manufacturers to resolve those technical compliance issues in limited areas, if such lead time is needed. The NTE deficiency allowance should only be seen as an allowance for minor deviations from the NTE requirements. The NTE deficiency provisions contained in this final rule would allow a manufacturer to apply for relief from the NTE emission requirements under limited conditions. EPA expects that manufacturers should have the

necessary functioning emission control hardware in place to comply with the NTE, especially given the lead time afforded to the NTE requirements in this final rule. Nonetheless, we recognize that there may be situations where a deficiency(ies) is necessary and appropriate. Deficiencies will be approved on an engine model basis, for a single model year, though a manufacturer may request a deficiency for all models and/or horsepower ratings within an engine family, if appropriate. These limitations are intended to prevent a manufacturer from using the deficiency allowance as a means to avoid compliance or delay implementation of any emission control hardware or to compromise the overall effectiveness of the NTE emission requirements. The Agency has established the deficiency provision for model years 2007 through 2009, which will provide three additional model years for manufacturers who encounter difficulties with the NTE requirements to resolve any remaining technical issues. Additional discussion of the deficiency provision is contained in the preamble to this final rule.

Other NTE Issues

EMA commented that to comply with the NTE requirements, emissions of NOx in the higher emitting modes will need to be substantially reduced, and may require additional technology. EMA claims the development costs may be out of proportion to the emission benefits of the NTE, and EMA suggests this critical cost data is not known because EPA did not perform the necessary analysis. We agree that the NTE standard will require the manufacturers to spend additional development time examining the emissions from their engines and putting engineering effort into controlling emissions throughout the entire NTE control zone. However, as discussed previously, we do not believe this will require the development of new technology beyond the technology necessary to comply with the 2004 standards. Rather, we expect for the majority of HDDEs the majority of the NTE requirements can be met today, and only incremental improvements in the 2004 technology (improved sensors, actuators, and turbomachinery) will be needed for the NTE standard to be feasible for all HDDEs by 2007. As discussed in Chapter 4 of the RIA for this final rule (and in Chapter 4 of the RIA for the proposal), we have included estimates for the additional costs for development time for manufacturers to comply with the NTE (and the other supplemental requirements), which we did not receive comment on. As discussed in Chapter 8 of the RIA, the Agency included the costs of the NTE in our overall cost-effectiveness estimate for the HDDE standards, and the results show these standards are very cost-effective (the 30-year fleet average presented in Chapter 8 shows a discounted NMHC+NOx cost-effectiveness of $1,230/ton). EMA's comments indicated they believe the Agency should perform some type of marginal cost-effectiveness analysis (the EMA comments are not clear regarding what type of analysis they believe EPA must perform) regarding the NTE requirements. The CAA requires the Agency to consider cost among other factors and we believe that our cost-effectiveness analysis is an appropriate way to consider costs. In addition, a marginal cost-effectiveness analysis would not be helpful in evaluating the NTE requirements. To perform such an analysis implies the emission benefits of the NTE can easily be separated from the emission benefits of the preexisting FTP and the SSS; however, this is not the case. The FTP and the SSS apply to engine operation that is included in the NTE (though they also cover engine operation outside of the NTE requirements). In addition, the defeat device prohibition is designed to protect against reduced emission control outside of FTP conditions. It is difficult, if not impossible, to determine how much emission reduction could be attributed separately to the NTE requirements as compared to the preexisting FTP, the SSS requirements, or the defeat device prohibition. However, EPA can say that, given the emission levels of engines which were actually produced by some engine manufacturers between 1988 and 1998 prior to the NTE requirements and prior to the heavy-duty consent decrees, the

emission reduction from the new standards as a whole (i.e., the 2004 and the 2007 standards), and from the supplemental standards in particular, are very cost-effective. The supplemental standards, including the NTE, ensure emission control over a broad range of engine and vehicle operation that is currently not adequately represented on the existing FTP. This includes operation that accounts for a large amount of HD vehicle use. Thus, it is not accurate to say that the NTE only restricts emissions during engine operation seen rarely in use.

EMA also commented that Congress has placed the burden of demonstrating feasiblity and cost-effectiveness on EPA, and EMA believes the Agency has not met this burden. Regarding the comment on technological feasiblity, as discussed previously in this section, the Agency has met the statutory requirement in the Clean Air Act regarding our obligations to demonstrate that the NTE requirements would be technologically appropriate in the 2007 time frame. EMA's comments regarding cost-effectiveness are incorrect. The CAA requires the Agency to consider a number of factors, including costs, which we have done (see Chapter 4 of the RIA for this final rule for a description of the cost analysis performed by EPA for this rule).

Mack commented that their current engines which meet an NTE limit are a full 3g/bhp-hr NOx above the current FTP level, while the proposed limits are only 0.625 g/bhp-hr above the 2004 FTP NMHC+NOx standard. However, as part of the requirements of their individual consent decrees, a number of HDDE families (greater than 75) have certified to SSS emission limits for all regulated pollutants, and to NTE limits for NOx. This certification data clearly indicates that 1998 HDDE engine technology (i.e., primarily injection timing strategies) is capable of meeting an NTE cap for NOx[13]. A large number of HDDEs (over 20 light, medium, and urban bus heavy-duty diesel engine families) are certifying to NTE limits today which are only 1 g/bhp-hr NOx above the current standard (i.e., 1.25 times the current standard). The RIA for this final rule contains a detailed discussion of the emission reduction capabilities of cooled EGR, advanced turbochargers, second generation electronic fuel injection systems and electronic engine controls which we anticipate being used to meet the 2004 and 2007 HD diesel emission standards. As discussed in the RIA, the combination of these technologies have the capability to reduce NOx emissions between 60 and 90 percent depending on the operating condition. Achieving reductions of this magnitude throughout the NTE control zone would allow manufacturers to achieve the NTE NOx standard. As discussed above, the emission control technology the Agency expects to be used to meet the 2004 standards are capable of producing the emission reductions necessary to comply with the NTE standard throughout the NTE zone by model year 2007.

GM and Isuzu commented that the NTE was an unsound approach because it is the aggregate emissions over a reasonable length of time which from an environmental standpoint are of concern, not emissions generated at any single moment of time. A similar comment was made by DaimlerChrysler. DC suggested that it is the total emissions generated during operation which should be of primary concern, not emissions generated during any single moment of operation or at any specific operating point. DC did not indicate what "a reasonable length of time" or what a "temporary condition" is, but they suggested that the following conditions fall into the category of temporary; "operation while heavily loaded, during acceleration up a hill, operating under extremely cold or hot ambient temperatures, operation at high elevation or traveling into a strong head wind."

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[13]See EPA memo to the docket regarding current HD Consent Decree federal certification requirements

Regarding the comments from GM/Isuzu, this comment is not a comment on the feasibility of the NTE, but a comment on the NTE approach. We disagree with this comment. As discussed in the proposal for this rule and elsewhere in this final action, the Agency has historically relied on the FTP and the prohibition on defeat devices to ensure that appropriate emission control occurs during normal vehicle operation and use, not just during the specific conditions and duty cycle defined by the FTP. No single test procedure with a pre-defined duty cycle can possibly represent all of the operating conditions which could occur during normal vehicle operation and use. The NTE requirements will ensure that during ambient conditions which do occur frequently in the U.S., and during normal vehicle operations covered by the NTE control zone, emissions are meeting a technically feasible emission standard, which is 25 percent above the FTP standard. It will also facilitate the Agency's ability to monitor in-use compliance. We therefore disagree with GM/Isuzu that the NTE approach is unsound or counterproductive.

We also disagree with the comments from DC. DC comments indicate they don't believe 30 seconds is a reasonable length of time over which manufacturers can control emissions. We believe that 30 seconds is a reasonable length of time. Thirty seconds is long enough to avoid short spike's in emissions which may occur from limited operating excursions, but 30 seconds is long enough for manufacturers to control for emissions during operation which may reasonably be expected to occur during normal vehicle operation in- use. As discussed in response to comment F under Issue 8.6, we expect that manufacturers can rely on their long experience in designing engines both for performance reasons as well as there existing requirements under the prohibition of defeat devices to control emissions during normal operation in use. DC suggests extremely high temperatures and altitudes are temporary conditions which they could not design an engine to comply with the NTE during. As discussed in response to comment K under issue 8.8, we have constrained the NTE upper temperature (option 2) and altitude (option 1 and option 2) compliance requirements in this final rule, which we believe eliminates extreme temperatures and altitudes. We also disagree that HD diesel engine operation while heavily loaded, or during an acceleration up a hill, or operating a truck into a strong head wind are conditions which manufacturers cannot anticipate or design for. These are situations which on-highway HD diesel vehicles in the U.S. experience every day of the year across the entire country. We believe that it is reasonable and appropriate that manufacturers can anticipate these types of operation and design for emission controls as well as for engine performance (which they obviously already do today, since the vehicles continue to operate under such conditions). Further, with respect to the minimum NTE 30 second sample time, manufacturers already design engines to meet smoke standards which include engine operation over a time frame nearly as short (lugging mode smoke test) or shorter than 30 seconds (acceleration mode smoke test). See the response to comment O under Issue 8.9 for a discussion of the existing smoke standard test.

GM and Isuzu commented that the NTE approach would restrict the manufacturers ability to use available calibration strategies to reduce overall emissions, and is thus technically unsound and inefficient means of controlling emissions. GM/Isuzu provided no specific examples of how the NTE approach restricts the use of available calibration strategies. GM/Isuzu also commented this was analogous to a situation which prevents averaging, banking and trading among engine families to achieve an overall emission target. We disagree with this comment. The existing FTP and the new SSS will require engine manufactures to design engines to meet the standards (e.g., 2.5 g/bhp-hr NMHC+NOx, 0.10 g/bhp-hr PM) using what ever calibration strategies they believe are appropriate. The NTE standard then requires manufacturers to look at their designs and make certain they do not exceed an overall emissions cap, which is 25 percent above the transient FTP standard.

Contrary to GM/Isuzu's comments, this is analogues to an ABT program. The heavy-duty ABT program for HD diesels promulgated in 1997 also has a cap on an engine families family emission limit (FEL) for NMHC+NOx. Specifically, §86.004-11(a)(1)(i)(D) requires that no HDDE NMHC+NOx FEL can be greater than 4.5 g/bhp-hr, i.e., the engine's FEL is capped.

Several commenters suggested that the NTE requirements were designed based on the feasibility of 1998 technology engines via the HD diesel consent decrees signed by a number of engine manufactures. It is correct that the NTE contained in the proposal and contained in today's final rule is partially an outgrowth of the HD Consent Decrees. However it is incorrect that the NTE concept and the NTE cap (1.25 x FTP standard) was based solely on 1998 technology HDDEs. The HD consent decrees were developed with a full recognition that the 2004 HDDE standards affirmed in this final rule would require the use of cooled EGR systems, and the HD consent decree clearly apply to the 2004 technology engines via the "pull ahead" requirements in a number of the HD Consent Decrees. While it may be correct that the NTE zone size, shape, and carve-outs are appropriate for 1998 engines, the NTE zone size, shape and carve-outs are also appropriate for 2007 technology engines. We gave careful consideration to the make-up of the NTE requirements contained in our NPRM (see 64 FR 58490 - 58493, which describes the definition of the proposed zone, the rationale for the proposed zones, and discusses the PM carve-outs). In this final rule we have adjusted those requirements where appropriate based on the comments and information we have received. We have presented a comprehensive description of the technologies which could be used by the engine manufacturers in order to comply with the HDDE 2004 standards and the HDDE 2007 standards, including the NTE requirements.

We also disagree with the comments that the NTE requirements will force manufacturers to target an engine's certification level well below the MY2004 FTP standards. A number of the emission control strategies available to engine manufacturers, including injection timing and EGR flow rates, are modulated values which a manufacturer can control to achieve a desired emission level. An emission control strategy which produces an FTP standard at the 2004 level can be used to meet an NTE level which is within the NTE standard of 1.25 times the FTP standard without forcing the FTP certification level significantly below the FTP standard. A similar statement applies to the Supplemental Steady State test. This has also been demonstrated by those engines which are certifying to NTE and SSS limits today under the various consent decrees some engine manufacturers entered into with the government. A large number of model year 1999 and 2000 engine families meet SSS and NTE emission limits, yet the FTP limits for these engines have changed very little from model year 1998 engine families.[14] Though these engines do not utilized EGR, they do use injection timing as the principle emission control technology, and manufacturers have used injection timing to meet SSS and NTE limits without needing to certify to emission levels significantly below the FTP standard, because injection timing can be modulated to provide appropriate emission control during various engine operation without going significantly beyond the reduction required, and EGR has this same capability.

We disagree with the comments that the NTE PM carve-outs are not appropriate in size or scope. As discussed in the proposal and the final rule, the PM carve-outs provide relief from the

[14] See EPA memo to Air Docket A-98-32, "Summary of Model Year 1999 and 2000 Federal On-highway Heavy-duty Diesel Engine Families Certified as Compliant with Not-to-Exceed Requirements, Euro-3 Steady State Requirements, and Maximum Allowable Emission Limits Requirements".

NTE standard in areas where we do not believe the 1.25 cap can be achieved, and this PM carve-out is different for low-speed and high-speed HDDEs. Navistar commented that the Agency did not solicit input regarding Navistar's specific line of engine families, yet that is exactly the purpose of the proposal, to solicit comment from all parties, and Navistar's comments on the rule did not provide specific comments or data regarding the PM carve-outs. Commenters did not provide any specific recommendations on how to change the proposed carve-out regions, and we have made no changes in this final rule.

DaimlerChrysler commented EPA did not provide any quantifiable environmental benefits of the NTE requirements compared to the FTP. In our proposal and in this final rule, we have explained that the NTE requirements are a necessary and appropriate way to ensure that the environmental benefits we expect to occur from the FTP standard actually occur in-use. We have also explained that the NTE (and the SSS) are intended to supplement the existing FTP and the existing prohibition against defeat devices.

DaimlerChrysler commented that manufacturers must design engines to meet emission standards and be fuel efficient, and that the NTE requirements ignore these dual requirements and only focuses on emission standards, and the result will be an increase in CO2 and an increased cost to the trucking industry. We disagree with this comment. The Agency recognizes that fuel efficiency is an important design factor for HDDEs, and the CAA requires the Agency to consider the impacts on costs and impacts on energy, which we have done. As discussed in Chapters 3, 4, and 8 of the RIA for this final rule, we have examined the technologies we expect to be used to comply with the 2004 and the 2007 standards, including the NTE standards, and we do not expect any negative impacts on fuel efficiency for HDDEs. In addition, in the event our conclusions prove to be incorrect and the standards contained in this final rule do have a negative impact on fuel efficiency we have performed a sensitivity analysis regarding the overall cost-effectiveness for this program, and the results indicate that even with a one percent increase in fuel consumption (which we do not expect to occur), this final rule would continue to be very cost-effective (See Chapter 8, Section IV of the RIA for a detailed discussion of the sensitivity analysis we performed).

DaimlerChrysler (DC) commented that they have run a test program to evaluate the technical feasiblity of the NTE, and after completing running approximately a 20 load-point test, they do not believe the proposed NTE NOx standard can be achieved for a number of load-points without significant increases in fuel consumption. It is not possible for the Agency to respond to this comment. DC provided no description of the test program, the test engine, or the test results.

DaimlerChrysler (DC) commented that relatively high brake specific emissions may occur at some low load and low speed operating modes which are outside the engine's typical operating range. Though DC does not describe why emissions are relatively high in these low load and speed operating modes, we assume they are referring to the fact that brake specific emissions, which is a measure of mass emission rate (i.e., mass of pollutant per unit time, such as grams/hour) divided by brake-power (e.g., brake-horsepower), will increase rapidly as the power, which is proportional to speed time torque, decreases, and in fact the brake-specific emissions will approach infinity as the torque approaches zero. We agree that low load and low speed operating modes should not be part of the NTE requirements. The NTE control zone excludes all engine operation below 30 percent of the maximum engine torque, and below a specified engine rotational speed which is based on the maximum power of the engine. Because HDDEs do not operate frequently at speeds that occur below the maximum torque of the engine, and HDDEs do not operate frequently at torques below 30

percent of the maximum torque, these regions are not part of the NTE. Therefore, DC's comment regarding the potential for relatively high brake specific emissions in this region are not relevant to the feasibility of the NTE standard, and their comments support our definition of the boundaries of the NTE control zone. Torque levels higher than 30 percent are part of the NTE control zone (only those torque values higher than 30 percent which also occur at engine speeds greater than the lower engine speed boundary of the NTE control zone). HDDE typically utilize torque values greater than 30 percent during normal operation, and these torque levels are included within the NTE control zone. In these higher torque regions, the value of brake-specific emissions (mass emissions divided by power divided by time) are not so high because the power value in the denominator is a relatively large value (power is proportional to torque times engine speed), so the mathematical phenomenon which DC alludes to is not a factor. As discussed previously in this section, the NTE standards are feasible within the control zone as it is defined in this final rule by 2007.

A number of commenters suggested that without information regarding how the existing FTP correlates to the FTP, it is not possible to know how stringent the NTE is, or if the NTE is feasible. We disagree with these comments. As discussed in response to Comment C under Issue 8.3, the issue of whether or not the NTE is more or less stringent than the existing FTP is not relevant to the Agency's standard setting process. Based on the information presented in this final rulemaking we have determined the NTE standards are feasible and appropriate for model year 2007. The issue of how the NTE compares in stringency to the existing FTP, or how the NTE correlates to the existing FTP is not relevant to the critical question the Agency must answer - which is whether or not the NTE requirements contained in this final rule are technologically feasible and otherwise appropriate under the CAA by model year 2007, and the Agency has determined that the answer to this critical question is yes.

GM/Isuzu commented that based on data they collected on HD gasoline engines the NTE requirements are not appropriate for HD gasoline engines. This rule does not establish NTE requirements for HD gasoline engines. Therefore, EPA has not made any decisions on the validity of these comments with respect to requirements for HDGEs. We do not believe the comments and data submitted by GM/Isuzu regarding HD gasoline engines are informative of the feasibility or appropriateness of the NTE requirements for HD diesel engines, because these are different engines which must meet different emission standards and which utilize completely different emission control technology.

We appreciate the concerns raised by the New York State Dept. of Environmental Conservation (NYS-DEC) regarding the NTE control zone and the possibility of gaming by manufacturers to avoid compliance with the NTE. However, the engine operating speed of 1,100 referenced by NYS-DEC was only used in the proposed preamble as a representative example. The procedures defined in the regulations for the definition of the NTE control zone define a control zone which is specific to each engine rating, and the procedure is designed to capture the operating region of an engine which is typically utilized during most on-highway operation. Therefore, we believe the NTE procedures contained in the regulations for this final rule address the concern raised by the NYS-DEC.

COMMENT I: EMA commented that the NTE proposal limits the stringency of the emission limits EPA can adopt. EMA states that, consistent with CAA Section 202(a)(3), EPA must take into account technical feasibility when setting emission limits for HD engines and vehicles. EMA believes that with the NTE requirements in place, it is the highest-emitting operating modes within

the NTE zone which must be used to establish technical feasibility, and the stringency of standards will be limited by the availability of cost-effective technology which will allow the worst-case modes to meet the NTE limits. EMA states that this is true even if the worst case modes are rarely encountered in use and have minimal contributions to emission inventories. EMA suggests EPA has failed to conduct this requisite type of feasibility analysis, thus EPA's proposal is unjustified and fundamentally unsound. **(Engine Manufacturers Association (IV-D-05))**

RESPONSE: We disagree with this comment. It is unclear if EMA's comment is regarding the Agency's future standard setting activities for HDDEs, or if the comment refers to the NTE standards proposed in the rulemaking action which lead to today's final rule.

To the extent the comment refers to today's final rule, it is unclear why EMA believes the NTE limits the stringency of the emission standard. As discussed in the proposal and elsewhere in this final rule, the NTE standard serves as a cap on HDDE emissions during specified engine operation during specified operating conditions. We have established this cap as being 1.25 times the FTP standard, because we believe the same control technology which will be used to meet the 2004 FTP standard can be used to meet the 2007 NTE standard. It is unclear how this approach limits the stringency of the standards contained in this final rule.

Regarding EMA's comment on the type of feasiblity analysis EMA believes the Agency must perform, Clean Air Act Section 202(a)(3(A) states regarding the regulations which apply new emission standards for HC, CO, NOx and PM to heavy-duty vehicles or engines that such regulations "*shall contain standards which reflect the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which such standards apply, giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology*." EPA therefore does not have to show that the technology needed to meet the standard is available today; only that it will be available for the 2007 model year. In this rule EPA has evaluated the technical feasiblity for each of the standards: the FTP, SSS and the NTE. We have made various adjustments to the SSS and the NTE standards to address technical concerns. EPA has also taken into consideration the cost of these standards as a group. We believe the standards contained in this final rule comply with the statutory requirements. This includes the worst-case modes, which are discussed in the previous response.

COMMENT J: EMA commented that the NTE requirements will engender unacceptable uncertainties for manufacturers, as well as excessive development costs and will make it impossible for manufacturers to introduce new designs with certainty of compliance. Engine manufacturers require objective criteria that can be used to evaluate new product designs and provide assurance that compliance requirements will be met. EMA comments that the proposed NTE requirements will frustrate this basic tenet of manufacturing. EMA claims that the NTE would require manufacturers to perform extensive evaluation of their engine designs over a wide range of steady state and transient operating conditions and varied ambient conditions which exhibit the highest emissions. This development time and cost of additional testing will be significant, and if additional technology is required to meet the limits, the costs could be very substantial if not prohibitive. EMA claims EPA has failed to develop any cost data in this regard. EMA claims that the number of combinations of operating modes and ambient condition is literally infinite, making it impossible to ensure that the "worst-case"conditions has been tested and brought into compliance. Thus, EMA states that manufacturers may never be certain their new designs will meet the NTE requirements and manufacturers will be unfairly forced to accept some decree of compliance risk in order to introduce

new products. The net effect of such increased costs, uncertainty and risk likely will be to discourage innovation and new product development, which is an unacceptable and unreasonable result. Navistar International Transportation also commented that manufacturers would need to test an infinite number of steady state and transient operations before they would know they could be in compliance. A similar comment was made by General Motors Corp. & Isuzu Motors America Inc., who commented the number of development tests required to assess an engine's performance would "increase exponentially", and would "exceed many thousands of tests per engine family." **(Engine Manufacturers Association (IV-D-05), Navistar International Transportation Corp. (IV-D-29), General Motors Corp. & Isuzu Motors America Inc. (IV-D-65))**

RESPONSE: We disagree with these comments. We have documented in the docket for this final rule a list of over 75 HDDE families which are complying with NTE emission limits today. As a result of the consent decrees entered into with the federal government, six HDDE manufacturers are complying with NTE emission limits today.[15] In addition, at least one engine manufacturer not required to meet NTE limits as part of a consent decree has submitted a statement of compliance for a HDDE family which includes a voluntary statement of compliance with NTE emission limits.[16] Therefore, a large number of engine manufacturers are already meeting NTE limits. The claim that NTE requirements will force unacceptable uncertainties, costs and risks on the manufacturers and that an infinite number of test combinations will be required before a manufacturer can demonstrate compliance is inconsistent with the large number of manufacturers who have already complied, some voluntarily, with NTE requirements.

We do not believe manufacturers will need to test an "infinite" or inappropriate number of steady state and transient combinations. This comment inaccurately assumes that the engine emission performance would be near the 1.25 cap under all or the majority of engine operation within the NTE control zone which could reasonable be anticipated to occur during normal operation and use. The manufacturers themselves in a number of places commented that the NTE requirements would force them to concentrate on the highest emitting modes. The Agency agrees with these comments. Engine manufacturers will be required to perform extensive mapping of their engine's emission performance across the NTE control zone (see for example the comments from DaimlerChrysler, comment IV-D-44, in which they commented that they would perform a 60 mode test program to evaluate the feasiblity of the NTE, and the comments from GM/Isuzu, attachment to comment IV-D-65, regarding their test program to evaluate the appropriateness of the NTE for HD gasoline engines for which they performed a variety of test programs ranging from 24 to 70 test points). However, manufacturers will be able to quickly narrow their test programs to focus in on those areas of the NTE control zone where the emissions are higher and are near the NTE emission limit. See for example the comments from Mack, IV-D-06, in which they imply that it is the upper left hand corner of the NTE where they must focus their engineering resources in order to comply with the NTE requirements. Engineering experience and logic dictates that manufacturers will not

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[15] See EPA memo to Air Docket A-98-32, "Summary of Model Year 1999 and 2000 Federal On-highway Heavy-duty Diesel Engine Families Certified as Compliant with Not-to-Exceed Requirements, Euro-3 Steady State Requirements, and Maximum Allowable Emission Limits Requirements".

[16] See - Statement of Compliance from Nissan for Engine Family YNDXH04.6FAB, available in EPA Air Docket A-98-32.

expend resources testing areas of the NTE control zone where emissions are well below the NTE standard. The same is true with respect to the expanded conditions which apply to the NTE. The manufacturers comments would indicate that under today's FTP, they must perform development tests at every 1 deg F increment between 68 and 86 deg. F, yet this is not what is done. As indicated by a number of commenters, the effects of temperature on emissions are fairly well known, and manufacturers will only focus testing resources at the conditions which result in the highest emissions. If the emissions under these conditions can be controlled to meet the standard, then emissions will clearly meet the standards at the less difficult to meet conditions. For example, NOx emissions tend to increase with temperature, and they decrease with decreasing temperature. The manufacturers do not need to waste testing resources and development time on lower ambient temperature compliance with the NMHC+NOx NTE standard, when they clearly know that higher temperatures are more difficult, and if the engine complies at higher temperatures it will then comply at lower temperatures. See also the comments from Detroit Diesel Corporation (comment IV-D-28) regarding the development of efficient testing schemes to determine compliance with the NTE, which indicates manufacturers have the capability to create NTE development tests which are "efficient", i.e., that do not waste testing resources. In our proposal and in this final rule we have estimated, based on our engineering judgement, that manufacturers would spend on average $500,000 per engine family of additional development costs in order to ensure they meet the NTE and SSS requirements. This represents a small fraction of the total costs of this rule. See Chapter 4(II)(A)(6) of the RIA for this final rule. This is above and beyond the extensive research and development, fixed costs, and variable hardware costs necessary to meet the 2004 FTP standards, which represent the majority of our cost estimates for meeting the 2004 and 2007 standards. See Issue 6 in this document for additional discussion of our responses to the comments we received regarding the costs of this rule.

We also disagree with the comment that new technology, beyond that required to comply with the 2004 FTP standards, will be required to meet the NTE. As discussed in the preamble, RIA, and elsewhere in the docket for this rulemaking, we have presented a large body of evidence which indicates the NTE requirements contained in this final rule can be met with the same technology used to meet the 2004 FTP standard in the 2007 time frame. In response to comment H under Issue 8.8, we discuss the technical issues which manufacturers must overcome in order to comply with the 2007 NTE standards, and these issues involve solving issues which deal with the application of cooled EGR, advanced turbochargers, and advanced electronic controls. In combination with next generation fuel injection systems (such as common-rail systems), these are the same technologies the Agency expects will be used to comply with the 2004 HDDE standards. The technical issues involved in meeting the NTE thus require, in some cases, some improvements in the expected technologies, not new technologies.

COMMENT K: EMA commented that EPA has failed to consider the impact of expanded ambient conditions on the technological feasibility of the proposed standards. This comment was also made by Detroit Diesel Corporation (DDC). EMA states that EPA's proposal includes unnecessary and unjustified restriction on the use of correction factors, which is wholly unreasonable. Without allowing for such factors, EMA states an engine's compliance with emission standards must be assessed from the vantage point of worst case scenarios and manufacturers would need to design their engines to meet the standards under the most extreme conditions, even if those conditions are rarely or never encountered in actual use. Thus, EMA believes EPA's proposal imposes prohibitive and unreasonable burdens on manufacturers, while yielding questionable emission benefits. EMA recommends that EPA require emissions to be corrected, up or down, using appropriate correction

factors to a nominal value in the existing FTP range of 68 to 86 deg. F, i.e., 77 deg. F. EMA states that expanding the range beyond the current FTP testing conditions (68 to 86 deg. F) adds a significant increase in stringency. EMA also commented that EPA's proposal to require compliance with the NTE at all altitudes presents a number of problems. EMA states that allowing testing to occur at any altitude without any correction for the effect of altitude would have a significant, adverse impact on PM and smoke emissions. EMA states that at extreme altitude and temperature, the ability to deliver EGR is hampered. No discussion of what constitutes extreme altitude or temperature was included in EMA's comments. EMA also states that low atmospheric pressure can result in incomplete combustion which could result in increased hydrocarbons and smoke, as well as higher exhaust temperatures. EMA states all of these limit the ability of using EGR to control emissions. EMA comments that increased ambient air temperature increases the engine intake air temperature, which increases exhaust gas temperature and less EGR can be used in the engine.

EMA also stated that increased altitude and ambient temperature raise concerns whether cooled EGR can be used. EMA stated that under extreme conditions, the EGR cooler will not be able to lower the EGR temperature to the required temperature which could have been achieved in the absence of the extreme altitude and/or temperature requirements. EMA states that the increased EGR gas temperature could potentially cause damage to the engine, and therefore manufacturers will be unable to use EGR under such potentially damaging conditions.

EMA also commented that increased altitude and temperature affect the amount of EGR which can be delivered due to the relationship between the engine's intake and exhaust pressure, which is effected by altitude and temperature. EMA commented that as altitude and/or temperature increase, the area under the engine's torque curve within the NTE control zone over which EGR cannot be delivered becomes larger, thereby making it impossible to deliver the EGR required to meet the proposed standards.

EMA also commented that the limitation on the use of correction factors will lead to errors in enforcement testing. EMA states that engines which normally meet emission limits could be found to exceed the limits if tested under unfavorable ambient conditions. Passing or failing an enforcement test could be randomly influenced by test conditions rather than representing a true assessment of the effectiveness of the engines emission control system.

Finally, EMA stated that the extreme ambient conditions proposed by EPA, without appropriate correction factors, render compliance with the proposed standards technologically infeasible. To support this claim, EMA submitted a table summarizing the effects of temperature, humidity, and altitude on HD diesel engine emissions of PM, NOx, and smoke from four different references.

EMA recommends EPA not finalize the proposed temperature, humidity, and barometric pressure requirements, but instead require the use of appropriate correction factors to correct measured emissions to nominal ambient conditions.

Detroit Diesel Corporation commented that they object to the use of any correction scheme that only allow corrections when the ambient conditions are outside specified ranges. DDC commented that in the temperature and humidity effects on NOx and PM emissions are continuous functions, and not represented by the discontinuity implicit in EPA's proposal. DDC commented the correction scheme proposed by EPA will lead to uncertain and inconsistent enforcement decisions.

DDC commented that when tested at one end of an ambient condition range one level emissions may result, and when tested at the opposite level a different emission level may result from the same engine. DDC stated that any enforcement program based on such a scheme is inherently unfair and lacks credibility.

Navistar International commented that the expanded ambient conditions creates additional stringency and compliance uncertainty. Navistar commented that it has been estimated the expanded conditions, when combined with production variability and the uncertainty with the NTE 30 second sampling time would require manufacturers to target NTE emissions 23 percent below the NTE standard at all points during normal engine operation, which would further increase stringency.

DaimlerChrysler (DC) commented the proposed expanded conditions represent an undue burden upon manufacturers since EPA has not presented data to support the appropriateness of the proposed expanded ambient conditions, nor has EPA reviewed the technical feasibility for the proposed standards at the expanded conditions. DC comments that compliance with the NTE under all conditions which may reasonably be expected in normal vehicle operation and use represents an undue increase in stringency. DC comments that current correction factors demonstrate NOx emissions without correction for reference temperature and humidity levels will increase the stringency up to 10 percent in the worst case, this result makes comparability and reproducibility of emission tests results impossible thereby making the proposal arbitrary and capricious. DC recommends that at a minimum corrections to ambient conditions must be applied to the supplemental tests to correct the proposed “unreliable measurement methodology”.

General Motors Corp. & Isuzu Motors America Inc. (GM/Isuzu) commented the proposed expansion of the environmental conditions under which engines must meet the proposed standards results in an increase in both the stringency and the cost of the proposed standards. GM/Isuzu comment that manufacturers will need to build expensive environmental testing chambers. They also comment the broader ranges will not necessarily contribute to improved air quality. As an example of this, GM/Isuzu state that to the extent compliance is required at lower temperatures, reductions in NOx emissions will not contribute significantly to reducing ozone levels. GM/Isuzu conclude that especially at the extremes of the conditions EPA proposed, the new test procedures will not be cost-effective. GM/Isuzu state that, at a minimum, the NTE and MAEL temperature conditions should not be expanded beyond the current FTP range. **(Engine Manufacturers Association (IV-D-05), Detroit Diesel Corporation (IV-D-28), Navistar International Transportation Inc. (IV-D-29), DaimlerChrysler (IV-D-44)**, **General Motors Corporation and Isuzu Motors America Incorporated (IV-D-65))**

RESPONSE: We have made a number of changes to the expanded conditions contained in our proposal in response to the comments received. First, the final rule does not require compliance with the NTE at all altitudes. The proposal contained no upper limit for altitude compliance with the NTE. This final rule establishes an NTE upper altitude compliance limit of 5,500 feet.

Second, the final rule contains two options for ambient temperature compliance. Under option 1, manufacturers can choose to comply with the NTE limits at all altitudes less than or equal to 5,500 feet above sea level, under all temperature conditions. For temperatures outside a range of 55 - 95 deg. Fahrenheit (F), a correction factor for NOx and PM is allowed. Inside the 55 - 95 deg. F range no correction factor for temperature is allowed. This option is identical to the requirements for NTE ambient temperature compliance contained in the Consent Decrees signed by

a number of HD diesel engine manufacturers.

Under option 2, a manufacturer can choose to comply with the NTE limits at all altitudes less than or equal to 5,500 feet above sea level, for all temperatures less than a specified temperature at each altitude. The upper temperature limit under option two is 100 deg. F at sea-level and 86 deg. F at 5,500 feet above sea-level, with a linear interpolation for altitudes in between. Temperature correction factors for PM and NOx are allowed for temperatures less than 55 deg. F. However, unlike option one, under option two NTE limits do not apply above the upper temperature limits defined in the regulations. However, the prohibition against defeat devices would apply at the temperature regions above the limit defined under option two.

Under either operating condition option, emissions of NOx can be corrected for humidity outside a range from 50 to 75 grains of water per pound of dry air (7.14 to 10.71 grams of water per kilogram of dry air).

We have finalized two options so that those manufacturers subject to the HD diesel Consent Decrees who must meet NTE limits will not need to make any design changes in order to show compliance with the 2007 NTE standards by using option 1, which is the option required under the HD diesel Consent Decrees. Option 2 provides an alternative to option 1 for all manufacturers. Option 2 requires compliance with the NTE standards at slightly higher temperatures for lower altitudes (e.g., 100 deg. F at sea-level), and compliance with the NTE standards at lower temperatures at higher altitude (e.g. 86 F at 5,500 feet). Option 2 reduces the scope of the NTE requirements, by excluding areas of operation where EPA agrees there would be technological difficulties associated with meeting the NTE limits with increasing altitude and temperature using the technology we expect to be used on 2004 and 2007 engines (as discussed below).

We agree that under certain ambient conditions, compliance with the NTE may be very difficult if not technologically infeasible given the technology package we anticipate being available for meeting the 2004 and 2007 emission standards. The altitude and temperature boundaries of the NTE requirements have been adjusted to reflect this. Commenters did not suggest what constitutes extreme conditions of temperature and altitude. The Agency considers the altitude/temperature limits discussed above to be well within the boundaries of normal atmospheric conditions (i.e., temperatures of 100 deg. F at sea-level are common across the U.S., as well as temperatures of 86 deg. F at 5,500 feet), as well as altitudes which are reasonably expected to be encountered by on-highway HD engines and vehicles in the United States. We believe the standards are feasible under the altitude and temperature limits in this final rule.

We agree with the manufacturers comments that HD diesel engines equipped with cooled EGR technology (the technology anticipated to be used to comply with the 2004 standards as well as the 2007 NTE standards) can be impacted by changes in altitude. Increasing altitude results in lower density air, which, unless compensated for, would result in a lower air-fuel ratio as altitude increases. Today's modern on-highway HD diesel engines utilize turbochargers to increase the airflow into the engine. Turbochargers are able to partially compensate for this drop in air-fuel ratio, primarily in two ways. First, as air density decreases with increasing altitude, air-fuel ratio drops and therefore exhaust gas temperature increases, shifting the balance between the turbine and the compressor in favor of the compressor, increasing pressure ratios, which will partially off-set the decreasing air density. Second, as the ambient pressure drops, the expansion ratio of the turbine increases, which also raises the compressor pressure ratio, as long as the inlet pressure does not

decrease as rapidly as the ambient pressure.[17] The reference by Watson et. al. estimate that for a change in altitude from sea-level to 3,000 meters (9,842 feet), ambient pressure decreases by approximately 30 percent, but intake manifold pressure for a turbocharged, intercooled engine decreases by only approximately 10 percent, and air-fuel ratio decreases by approximately 6 percent. Therefore turbo machinery can partially compensate for the decrease in air-density with altitude. In order to maintain appropriate air-fuel ratio control at altitude, manufacturers must therefore design for excess air-fuel ratio at low altitudes in order to maintain adequate air-fuel ratio control at altitude. Based on the available lead time (nearly 7 years), the reduced temperature requirements at altitude, and the upper NTE altitude limit of 5,500 feet contained in this final rule, we are confident the NTE standards contained in this final rule can be met at altitude (i.e., 5,500 feet) because of opportunity for manufacturers to design their engines with sufficient excess air-fuel ratios at low altitude to compensate for the decrease in air density with increasing altitude while still maintaining PM emissions within the NTE PM standard.

We disagree with the comments that the ambient temperature and humidity correction factor methods for NTE testing contained in the final rule are inappropriate. DDC suggests that any scheme that doesn't correct to a single condition is inherently unfair and lacks credibility. This statement is not supportable. For more than 20 years the Agency has required heavy-duty engine FTP testing which has no temperature correction factors for any pollutant between the range of 68 and 86 deg. F, and the feasibility of FTP is based in part on the feasibility of the standard in this temperature range. The NTE expands this temperature range, which is appropriate given that increases in NOx, particularly at temperatures above 86 deg. F, could well lead to greater ground level ozone, given that ground level ozone is more prevalent in warmer weather. Temperatures up to 100 deg. F are not uncommon in many locations throughout the United States, and thus are justifiably represented under the NTE.

The NTE is technically feasible within the specified temperature range. When outside the specified NTE temperature range, the Agency is providing the opportunity for a correction factor to compensate for the effects of temperature above (for option 1) and below (for option 1 and 2) the specified range, where there is a range without correction. To correct back to a single value within that range could have unanticipated consequences. For example, for temperatures below 55 deg. F, the final rule allows corrections factors to be used for PM and NOx emissions to correct back to 55 deg. F. To correct back to some other temperature, such as 77 deg. F, could have the effect of making the temperatures below 55 deg. F more or less stringent than at 55 deg. F, which is not appropriate for the same reason NOx and PM emissions are not corrected for temperature during the existing transient FTP test between 68 and 86 deg. F. Therefore, we require correction back to the nearest end point. This same rationale exists for the final rule's NTE humidity correction factor provisions. We also disagree with DDC's and DaimlerChrysler's comments regarding the enforceablity of the NTE provisions with respect to correction factors and the "unreliable measurement methodology". DDC states that the same engine could be tested at the two far ends of the ambient condition range and have two different emission results, yet be compared to the same standard. DDC implies this is unfair and lacks credibility, yet that is exactly what occurs today, and has for our light-duty and heavy-duty program for over 3 decades. Manufacturers are

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[17] See Chapter 10.9 of "Turbocharging the Internal Combustion Engine", N. Watson and M.S. Janota, John Wiley & Sons, New York, 1982, a copy of which is available for review in EPA Air Docket A-98-32, Docket Item IV-G-09.

expected to meet EPA's standards not just at a single temperature, but throughout the regulated temperature range. Under today's program, EPA may test a HD diesel engine at 68F and at 86F, and no temperature correction factor for any pollutant is allowed, and the engine must comply with the same emission standard. Under today's HD (and light-duty as well as off-highway programs) program manufactures must design for the "worst-case" conditions within the specified ambient test procedure conditions, today's final rule does not change this fundamental premise. This final rule contains no fundamental change in EPA's historical approach regarding HD diesel engine enforcement with respect to temperature and humidity ranges. For a new standard (NTE) , we are simply increasing the temperature range over which no correction factors are allowed, as a way to better represent the broad variety of in-use conditions and ensure emissions control over this range.

We also disagree with Navistar's comments regarding additional stringency and compliance uncertainty. Navistar provides an estimated increase in uncertainties of 23 percent, but the data behind these estimates is not referenced or provided. Regarding Navistar's comments on stringency, please see the discussion on the technical feasibility of the NTE under the response to comment H under issue 8.8.

COMMENT L: EMA commented that EPA's proposed NTE requirements for particulate matter (PM) should be eliminated. EMA provided two reasons for their recommendation; first, the proposed 30-second sample period for NTE testing would not allow for collection of a representative PM sample because measurement equipment is not accurate enough to measure the mass of PM which would be collected over this period of time. EMA points to the existing provisions for HD transient testing (40 CFR Part 86, Subpart N) as support for their statements; "Existing regulations (Part 86, subpart N) suggest a recommended loading of 1 mg of PM for a representative sample to be collected on a filter during a test."). Second, EMA stated that some advanced aftertreatment devices, such as particulate traps and NOx adsorbers, require regeneration cycles which result in an increase in emissions which a 30 second sample period would not representatively reflect.

Detroit Diesel Corporation commented the proposed NTE PM requirements would be problematic. DDC stated the PM issue is one of work load and burden, not a technical feasibility issue, because the NTE PM requirements would require long engine sampling times in order to obtain a sufficient mass of PM on a filter for a reasonably accurate measurement. **(Engine Manufacturers Association (IV-D-05), Detroit Diesel Corporation (IV-D-28))**

RESPONSE: We disagree with a number of these comments, and no change to the NTE PM requirements have been made. First, measurement equipment exists today which allows PM mass based measurements to be very accurately measured. 40 CFR Part 86, Subpart N describes test procedure requirements for measuring HDDE PM emissions during the 20-minute transient test cycle for today's PM standard of 0.1 g/bhp-hr. This standard has been in place since 1994, and the measurement equipment specifications for PM sampling were originally published in 1985. It should be noted that EMA's claim that the CFR recommends a 1 mg sample is incorrect. 40 CFR 86.1312-88 (b) states "A filter pair loading of 1 mg is typically proportional to a 0.1 g/bhp-hr emission level." (underline emphasis added). This statement does not recommend a 1 mg loading, it simply implies that if the test procedure method described in 40 CFR Part N is followed for a HD diesel engine which emitted at the FTP PM standard of 0.1 g/bhp-hr, you would typically expect to collect 1 mg of PM sample on the filter pair. However, this is just a rule-of-thumb statement. There are many provisions within 40 CFR Part N which could be varied to come up with a different filter pair loading for an engine which had a certification PM level at 0.1g/bhp-hr over the existing FTP test.

PM measurement capabilities have progressed substantially since 1985. For example, the 40 CFR 86.1312 contains weighing balance specifications with a precision of 20 micrograms, and a readability of 10 micrograms; however, microgram scales available today are considerably better. EPA recently performed a PM measurement study at our testing laboratory in Ann Arbor, Michigan with a microbalance scale with an accuracy of 0.3 micrograms (up to 2grams total mass) and a resolution of 0.1 micrograms. A summary of this study is available in the docket for this rulemaking.[18] The memorandum also contains an analysis by EPA of PM measurement capabilities using laboratory filter based methods. The memorandum shows that currently available laboratory equipment and techniques are capable of measuring very low levels of PM mass, and that diesel engines operating near the NTE standard of 0.125g/bhp-hr would produce sufficient PM under a wide range of engine operation to be accurately measured. It is reasonable to expect that engine manufacturers who have not already done so can make similar improvements to their PM collection and measurement equipment in sufficient time to properly design engines to meet the PM NTE standards contained in this final rule. It is quite likely that for HD diesel engines which are well below the NTE PM standard, 30 seconds would not be sufficient to collect an accurate PM measurement. This on its own is relevant to show compliance under such a test condition. PM measurement on such an engine would either require a longer sample period (since the 30 seconds is the minimum NTE time), more accurate equipment, or possibly replicate runs in the laboratory over the same cycle to accumulate sufficient sample to be within the given equipments acceptable measurement range. These same statements also apply to urban bus engines, which would need to meet an NTE PM standard of 1.25 times the FTP standard, or 0.0625 g/bhp-hr.

In the event the Agency collected an NTE PM sample and the Agency was not able to accurately measure the amount of PM collected, we would of course not take any compliance or enforcement action based on such data. If such a measurement issue arose, we would either run replicate test to improve the measurement accuracy, select a longer sampling time in order to collect sufficient sample for an accurate measurement, or acquire more accurate measurement equipment.

We also disagree with EMA's comment that the NTE PM provisions should be changed because of advanced aftertreatment devices. PM traps are available which do not have active regeneration cycles. PM traps with active regeneration cycles, such as burner assisted traps, were investigated in the early 1990's, but engine manufacturers have tended not to use them because of their complexity, cost, and reliability issues, and no such traps are currently being used by any on-highway HDDE family. A number of the PM traps discussed in the RIA for this final rule are "passive" devices, i.e., they are continually regenerating, and therefore they do not have discreet regeneration events. If a manufacturer did use a PM trap for the 2007 NTE requirements, it's unlikely the device would have discreet regeneration events because the preferred PM trap design approach is to develop continuously regenerable traps. If a manufacturer did utilize a PM trap which during normal vehicle operation and use emitted PM at a rate which would exceed 0.125 g/bhp-hr (0.625 for urban buses) for a 30 second or more duration, this is the exact type of operation the Agency is concerned in preventing with the NTE standards, and we believe such a PM trap would not be an acceptable emission control device. Therefore, the NTE PM provision does not exclude the use of advanced PM traps, it only prevents the use of those PM traps which would emit large amounts of particulate matter during regeneration events.

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[18] See "Data and Discussion on Particulate Matter Measurement Errors and Sampling Times for Filter Based Methods", M. Samulski and M. Spears, available in EPA Air Docket A-98-32.

The EMA comment infers that the regeneration events from NOx adsorbers makes the minimum 30 second sample time for the NTE NMHC+NOx standard in appropriate. We disagree with this inference. If a NOx catalyst formulation used by the engine manufacturer has regeneration events which result in an exceedance of 3.125 g/bhp-hr NMHC+NOx for a 30 second or greater period of time during operation covered by the NTE standard, we do not believe such NOx catalyst is an acceptable emission control device. However, the NTE standards to not restrict the use of all NOx adsorber aftertreatment devices which require a regeneration cycle, only those which are not designed to control emissions within the NTE standard during regenerations which occur during NTE operation. NOx adsorbers are an emerging technology, and a number of technical papers have been published recently regarding the application of NOx adsorbers to diesel engine which would control NOx emissions during the regeneration of the catalysts. For example, see Society of Automotive Engineers papers 2000-01-1012 and 2000-01-1932, which discuss the use of a dual-bed NOx adsorber, which allows one bed of the adsorber to be active while the second bed is regenerating, and vice-versa, which would control NOx emissions during the regeneration event. Therefore, we disagree with the inferred comment that the minimum 30 second NTE NMHC+NOx sample time should be eliminated because it prevents the use of advanced NOx adsorbers. The requirement only prevents the use of poorly designed NOx adsorbers. In any case, as discussed in the preamble, NOx adsorbers will not be necessary to meet the standards in this rule.

Finally, we disagree with the comment that a 30 second time frame is not a long enough period of time to be representative. The commenter misunderstands the purpose of the NTE requirements. The NTE is not intended to be an average, in-use requirement. The preamble in the NPRM, as well as this final rule, clearly state that the NTE requirements are a cap on emissions, i.e., PM emissions should go no higher than 1.25 times the standard (0.10 g/bhp-hr for HDDEs, except urban buses which have a PM standard of 0.05 g/bhp-hr) during operation which falls within the NTE control zone during the ambient conditions covered by the NTE standards. Therefore, it does not make sense to lengthen the sampling time for PM measurement during the NTE to collect a long, average sample, when the intent is to limit the maximum PM emissions allowed at any one time.

We agree with DDC that the PM NTE requirements are not a technological feasibility concern. DDC commented that the NTE PM requirements would increase the work load and burden on the engine manufacturers. While we agree with this comment, we do not expect this increased work load to be significant, and we expect manufacturers may decide to significantly improve their PM measurement capabilities to minimize the increased work load due to the PM NTE requirements; that is, with more accurate equipment which would maximize the PM mass collected and minimize the minimum amount of PM mass necessary for an accurate measurement. Thus manufacturers would not need to run replicate test cycles for engine operation which produce PM mass emission rates near the accuracy limits of their current measurement equipment. In addition, the extra lead time provided by delaying the NTE till 2007 should help manufacturers better prepare for any work load increase resulting from the NTE requirements.

COMMENT M: EMA commented that NTE testing under transient conditions is not practical. EMA commented that during real world operation, engine speed and/or load vary significantly, and often move in and out of the proposed NTE control zone. EMA commented that EPA failed to explain how sampling time would be determined under transient operations. EMA concludes that EPA should eliminate transient NTE requirements, or at a minimum EPA should provide guidance as to how sampling time will be determined under real-world conditions.

Detroit Diesel Corporation commented the transient aspects of the NTE adds an additional layer of complexity, expense and uncertainty. DDC states that developing efficient testing schemes to demonstrate transient compliance with the NTE will be extremely difficult. DDC comments the benefit of the transient component of the NTE is out of proportion to the development and compliance demonstration costs which will be incurred. DDC recommends the transient engine operation provisions of the NTE be removed. **(Engine Manufacturers Association (IV-D-05), Detroit Diesel Corporation (IV-D-28))**

RESPONSE: We disagree with these comments. The NTE emission standards contained in this final rule apply for transient as well as steady-state engine operation. During engine testing for compliance testing, engine speed and load would need to be measured and recorded with sufficient accuracy to know when the engine is operating within the NTE control zone, regardless of whether the testing is being performed in the laboratory or in a vehicle, on the road. If an engine is operating outside the NTE control zone, then clearly such operation would not be subject to the NTE requirements. EMA comments regarding sample time do not make technical sense, or their arguments have not been clearly presented. EMA's comment was "*EPA fails to explain how sampling time will be determined under transient operations*." (see page 30 of EMA's comments, item IV-D-05 in EPA Air Docket A-98-32. Sample time is a well understood concept, it simply means the duration of time during which an emissions sample is collected. During transient engine operation within the NTE control zone, sample time can be any length of time as short as 30 seconds. Longer sample times would clearly fall within the range of acceptable sampling times covered by the NTE. During emissions sampling, the testing entity would need to keep track of the length of the sample time, for example by using a strip chart or more likely using an automatic data recording system. Transient engine testing has been a required of HDDE manufacturers under the existing HD FTP duty-cycle for more than 10 years, and it is unclear what additional guidance EMA believes is needed regarding transient testing and sample time. The comments from EMA seem to infer there are issues regarding in-use, on the road measurement which the Agency has not addressed. See our response to Comment F under Issue 8.6, which discusses how the Agency will proceed with respect to in-use measurement equipment and procedures for in-use, on the road NTE compliance testing.

We also disagree that the suggested complexity of transient NTE testing outweighs the benefits. The commenter discusses the need to develop efficient testing schemes in order for manufacturers to gain confidence that they can comply with the transient provisions of the NTE. Manufacturers have a full seven years to develop and perfect cost-effective testing schemes related to NTE testing, and this lengthy time period should be more than adequate. As discussed under the response to Comment J under Issue 8.8, manufacturers will not waste development resources on test cycles which do not test the feasiblity limits of their engine designs. Manufacturers have indicated they know what regions of the NTE control zone present technical feasiblity concerns, and these are the regions they will focus on to assure compliance with the NTE. Clearly transient NTE testing will require more development time as compared to an NTE which only required compliance during steady-state engine operation. However, as already noted, manufacturers have a full seven model years to develop appropriate transient NTE testing schemes.

COMMENT N: Detroit Diesel Corporation commented the stated objective of the NTE in the proposal is virtually the same rationale which is provided for the existing defeat device prohibitions and the proposed SSS test procedure. DDC stated that this redundancy is not justified and they recommend the NTE should be eliminated. **(Detroit Diesel Corporation (IV-D-28))**

RESPONSE: We disagree with these comments, and we have retained the existing definition of defeat device in this final rule, as well as the SSS and NTE test procedures. The preamble for this final rule as well as the proposal provides a detailed discussion of why the SSS and NTE test procedures are both needed in addition to the Agency's existing regulatory and statutory authority regarding the prohibition of defeat devices, and these argument will only be summarized here. The defeat device definition is not a specific numeric standard, and therefore it does not provide the benefits of a numerical standard, including the fact that violation of a standard is a completely objective measure; thus, eliminating some of the imprecision of the defeat device prohibition. The NTE is a standard which serves as an upper cap on emissions during the engine operating conditions and ambient conditions defined in the regulations, i.e., emissions can be no greater than 1.25 times the FTP standard. Compliance for the NTE can be determined in a laboratory or on a vehicle during actual on the road operation making in-use testing more feasible as a compliance tool. The NTE covers a wide range of engine operating conditions as well as ambient conditions. The SSS is a test procedure more similar to the existing FTP, though it covers a different duty-cycle than the FTP and therefore covers specific engine operation not adequately covered by the FTP. The SSS test has a standard equal to the FTP standard, i.e., the SSS standard is 1.0 times the FTP standard, therefore, for the steady-state operation covered by the SSS, the emission standard is lower than the NTE standard (which is 1.25 times the FTP standard), and therefore provides emission benefits beyond that provided by the NTE standard for this specific type of engine operation. Compliance with the SSS can only be determined in the laboratory under the same standard laboratory conditions which apply to the FTP. Finally, the prohibition of defeat devices covers operation outside the applicable federal emission test procedures, i.e., in 2007 the prohibition against defeat devices will cover operation not substantially included in the FTP, the SSS and the NTE. Obviously, the test procedures cannot, by themselves, ensure the manufacturers are not using defeat devices outside the test parameters. For all of these reasons, the prohibition against defeat device, the NTE and the SSS are complementary to the FTP, and are not duplicative as suggested by the commenter. See also the response to Comment P under Issue 8.10 regarding the relationship between the SSS test and the prohibition against defeat devices.

Issue 8.9 NTE Smoke and Opacity Limits

COMMENT O: EMA commented that the proposed NTE smoke limits are redundant, and provide no environmental benefit. This comment was also made by Mack Truck. EMA states that EPA proposes a smoke limit for transient NTE operation, a smoke limit for steady-state NTE operation, a smoke limit for the load response test, and an NTE PM limit. EMA commented that all of these proposed requirements are controlling the same emission. EMA also comments that EPA failed to propose a definition of what constitutes transient vs. steady-state engine operation, and EPA failed to propose correction factors for temperature and barometric pressure. EMA comments that EPA must clarify what the new smoke limits are, if any, and what compliance program is intended to enforce such smoke limits. Finally, EMA comments that the proposed smoke limits are overly complex and costly, and should be eliminated.

Detroit Diesel Corporation commented that the proposed smoke opacity limit of 4 percent is extremely low. DDC commented that achieving this low level across the entire NTE control zone and over the expanded ambient conditions will be very difficult and may prove impossible.

(Engine Manufacturers Association (IV-D-05), Mack Truck Inc. (IV-D-06), Detroit Diesel Corporation (IV-D-28))

RESPONSE: Our proposal contained conflicting information regarding some aspects of the proposed smoke limits. Our proposed regulatory text language contained an error which we have corrected for the final rule. The proposed regulatory text contained smoke limits for the load response test, though the proposed preamble clearly stated no smoke limits, or any other standard, was being proposed for the load response test (see 64 FR 58494). Our final rule clarifies that no smoke data needs to be collected during the load response test, and no smoke standard (or any standard) applies to the load response test. The proposal for NTE smoke limits was not as clear as it could have been regarding the issue of transient vs. steady-state smoke requirements. This has been clarified for the final rule. The final rule requires the manufacturer to choose between two options for NTE smoke standards. Under option one, a manufacturer can choose to comply with a filter smoke limit of 1.0 on the Bosch smoke number scale during steady-state engine operation within the NTE control zone. Alternatively, under option two a manufacturer can choose to comply with a smoke opacity limit of four percent during both transient and steady-state engine operation within the NTE control zone.

We disagree with the comment that the 4 percent smoke opacity limit may prove to be impossible. Engine manufacturers meet smoke opacity limits today. The existing regulations applicable to HDDEs specify a smoke test which includes two modes of engine operation, see 40 CFR Part 86, subpart I. The two modes of the test procedure are the “acceleration” mode, and the “lugging” mode. Three smoke opacity standards apply to these modes; opacity during the acceleration mode must not exceed 20 percent, opacity during the lugging mode not exceed 15 percent, and the peak opacity any either mode must not exceed 50 percent. These same numerical opacity standards have been applicable to HDDEs for a number of years, see for example §86.091-11(b), and the same opacity standards continue to apply to MY2004 and MY2007 HDDEs. The acceleration mode defined in the regulations (see § 86.884-7(a)(2)), is an aggressive test cycle, which consists of three distinct accelerations, one lasting no more than 3 seconds (see § 86.884-7(a)(2)(i)), the second lasting 5± 1.5 seconds (see § 86.884-7(a)(2)(ii)), and the third lasting 10±2 seconds (see § 86.884-7(a)(2)(iv)). The lug mode consists of a single testing operation which lasts 35±5 seconds (see § 86.884-7(a)(3)(ii)). The opacity standards for the acceleration mode (20 percent) and the lugging mode (15 percent) are based on an average of opacity for each of the modes, and the peak opacity standard is based on the average of the highest opacity values measured during both the acceleration and the opacity modes. The acceleration mode cycles would be outside the NTE requirements because they are too short in duration and part of the modes would be outside of the NTE control zone. The lug mode test duration does fall within the minimum 30 second requirement for the NTE smoke test, but would likely not be required to meet the NTE smoke requirements because some of the operation falls outside of the NTE control zone. The peak opacity requirements from the existing FTP smoke requirements are clearly outside of the NTE requirements. The peak opacity looks at the a number of the highest individual opacity readings selected from the acceleration and lug modes. These are not from a continuous engine or vehicle operation, and would therefore not be covered by the NTE. We believe that in general the existing FTP smoke test is more aggressive than the NTE smoke requirements, because the existing FTP smoke requirements look at operation during shorter durations of time as compared to the NTE, and because the existing FTP smoke requirements includes a standard for the average of individual peak values from a series of tests, while the NTE smoke requirements are average values from a continuous engine operation.

In recent years, HDDE manufacturers have certified their engines significantly below the opacity standards. For example, the MY2000 HDDE certification data shows 24 engine families with

acceleration mode opacities ≤ 4 percent, and 14 engine families with acceleration mode opacities ≤ 2 percent. The MY2000 certification data shows 33 HDDE engine families with lug mode opacities ≤ 4 percent, and 25 engine families with lug mode opacities ≤ 2 percent. Fourteen MY2000 HDDE families are certified with peak opacity values ≤ 4 percent. It is clear from this data that the current FTP smoke opacity limits are easily met by HDDEs and that the NTE smoke opacity limits are feasible using current technology. Smoke emissions from HDDEs are a public nuisance, and high levels of smoke can impair visibility and degrade public and private property by dis-coloration. The existing standards cover distinct engine duty cycles, and manufacturers are certified well below those standards. The NTE smoke requirements in today's final rule are not technology forcing for HDDEs, but will ensure that the control strategies manufacturers use today are applied over the broader range of operating conditions of the NTE. The control technologies manufacturers use today to control smoke emissions, such as fueling limiters which are based on boost level or air/fuel ratio estimates, will continue to function on 2004 technology engines. Therefore, we disagree with the comments that these limits cannot be met in model year 2007.

In addition, a large number of HD diesel engine families produced by a number of manufacturers covered by the consent decrees entered into between the government and engine manufacturers in 1998 are certifying to an NTE smoke opacity limit of 4 percent or alternatively the filter smoke limit of 1.0 contained in this final rule today.[19] The NTE smoke and opacity limits contained in the consent decrees of a number of engine manufacturers are identical to the requirements contained in today's final rule.

With the correction of the load response test smoke error (i.e., no standards apply to the load response test), and the clarification of the NTE smoke requirements (two options as described above), our final rule requirements for NTE smoke limits are appropriate. We disagree with the comment that NTE smoke limits are not needed if NTE PM standards are also required. Manufacturers provided no data to support their claim that smoke and PM measurements are redundant, and no data was supplied to suggest a correction factor for temperature or barometric pressure are appropriate for smoke emissions. Requirements for smoke standards and PM standards are not equivalent and do not control the same pollutant. EPA has required separate PM and smoke limits for on-highway HD diesel engines in the past, and separate PM and smoke limits are appropriate for NTE engine operation. We did not propose temperature or barometric pressure correction factors for smoke testing, and we do not believe they are either appropriate or needed.

Issue 8.10 Supplemental Steady State Requirements

COMMENT P: EMA commented that the EPA should eliminate the Supplemental Steady-State (SSS) standards and test cycle from the final rule. EMA presents a number of arguments to support their suggestion. First, EMA states the proposed SSS is unduly burdensome and unnecessary. EMA states the NTE and the SSS appear to have the same purpose, to control in-use emissions; therefore, EPA has no justification for adopting both the SSS and the NTE.

Second, EMA commented that the proposed SSS test adds unnecessary certification testing and paperwork burdens. EMA commented that the data submission requirements proposed by EPA

[19]See EPA memo to the docket regarding current HD Consent Decree federal certification requirements.

for the SSS test are burdensome and EPA failed to provide reasons supporting the need for why such data should be submitted with the certification application. EMA commented that the requirement that for each SSS test mode the results must correspond to the maximum NOx-producing condition for a 30-second or longer averaging period could be interpreted to include the worst-case ambient conditions, which EMA believes is unduly burdensome and should be eliminated.

Third, EMA commented that the proposed SSS test procedure lacks clarity, are inconsistent, and create intolerable uncertainty for manufacturers attempting to determine their obligations. EMA provided a detailed list of concerns with the proposed regulatory test procedure language. This list was also included in the comments from Navistar International. Following the close of the comment period, Navistar International submitted additional comment on the proposed test procedure language in response to discussions with EPA.

Detroit Diesel Corporation (DDC) commented that they agree with EPA's assessment that the existing transient HDDE FTP duty-cycle does not fully represent today's driving patterns. However, DDC commented that EPA's existing regulations prohibit the use of defeat devices and gives EPA the necessary authority to ensure emissions are adequately controlled over the broadest possible range of operating conditions. DDC also commented that the proposed NTE, as described by EPA, was proposed to control emissions over a wide range of operating conditions. DDC stated that therefore EPA has three regulatory controls (prohibition against defeat devices, NTE, and SSS) which are largely redundant, but the costs are additive and the proposal is very cost-ineffective. Therefore, DDC recommends that EPA withdraw the SSS test from the final rule. **(Engine Manufacturers Association (IV-D-05), Detroit Diesel Corporation (IV-D-28))**

RESPONSE: We disagree with the comment that the SSS is unduly burdensome and unnecessary. Some commenters state that the NTE and SSS appear to have the same purpose, and therefore both are not necessary. However, the SSS has a purpose distinct from the NTE. The SSS is a steady-state test, consisting of 13 specific modes, and 4 of the 13 modes fall outside of the NTE control zone. The emission standard for the SSS is 1.0 times the engine's FEL or the emission standard, compared to the NTE standard of1.25 times the FEL or the emission standard. The NTE is designed as a cap on emissions at any time, where as the SSS is a test of average emissions over various steady-state operating conditions. Thus, the emission levels that must be met under the SSS is lower than the level to meet the NTE. These differences clearly indicate the the SSS and the NTE do not cover the same type of engine operation for the same purpose. The NTE, and SSS, in combination with the pre-existing transient FTP, are necessary to provide EPA with assurance that appropriate emission control is occurring across the broad range of operation which heavy-duty diesel engines encounter. The commenters did not provide any specific information or discussion to support their assertion that the SSS is unduly burdensome.

In general we disagree with the comments that the SSS unnecessarily adds to the certification testing and paperwork requirements for the engine manufacturers. The certification requirements with respect to testing requires manufacturers test one engine from each engine family and submit the specific data collected from that test. There is little change with respect to the certification testing burden as compared to what is performed today, except now the manufacturers must run one additional test cycle on the certification engine, in addition to the preexisting FTP. Some commenters suggested that the proposed requirements were a significant burden, but no information was submitted to support this claim. However, in light of the comments we received, we

have reviewed the proposed certification paperwork requirements and made a number of changes, dropping from the required list a number of the proposed data submission requirements. Specifically, we proposed that manufacturers must submit smoke opacity data at the time of certification. We reviewed this requirement and decided that, because the SSS test not include a smoke opacity standard, this data was not needed. We also proposed that manufacturers must submit at the time of certification all engineering information regarding the engine families ability to comply with a number of the applicable requirements (maximum NOx producing conditions for SSS testing, compliance with MAEL requirements, and compliance with NTE requirements). We have changed the final rule requirements such that manufacturers must only retain all applicable information at their facilities and must submit it to EPA only upon request.

We have retained as a requirement of certification a number of the data submission items proposed for the SSS, which are spelled out in the regulations in §86.007-21(o)(1) through §86.007-21(o)(5), as discussed below.

- §86.007-21(o)(1) requires that manufacturers must submit the weighted gaseous test results for the SSS for each pollutant for which there is an SSS standard. This requirement is clearly needed since it is the gaseous emissions results against which the engine will be compared to the standard, and it is hardly burdensome, manufacturers have been able for a number of years to submit certification application data to EPA electronically. In fact, in response to the HD diesel consent decrees between the Agency and a number of HD diesel manufacturers, the Agency has already changed our electronic certification software to enable engine manufacturers to submit the SSS data electronically, and a number of the CD manufacturers have chosen to do so.

- §86.007-21(o)(2) requires that manufacturers must submit the gaseous emission test results for each of the individual 13 SSS test modes, and the EPA selected mystery points. This information is needed for several reasons. First, the regulations require that no individual SSS mode which is within the NTE control zone can exceed the NTE emission standard, so the mode data is checked for this purpose. Second, the individual SSS mode points are needed in order to calculate the MAEL surface against which the mystery points are compared. Finally, the mystery point data is necessary to ensure that the EPA selected points comply with the MAEL standard. As discussed above, this information can be submitted electronically by the engine manufacturers.

- §86.007-21(o)(3) requires that manufacturers must submit individual SSS mode gaseous emissions concentration values and mass flow rate values for all regulated pollutants as well as carbon dioxide. This data is necessary for the Agency to evaluate the accuracy of the manufacturers test results. The gaseous concentration values and mass flow rates, including carbon dioxide emissions, are collected or calculated during the emissions testing procedure and are used to calculate the individual mode data, thus the Agency could use this data to verify the manufacturers calculation procedures.

- §86.007-21(o)(4) requires that manufacturers must submit values for all emission related engine control variables. The regulations require that the SSS test results correspond to the maximum NOx producing conditions which could occur during the SSS test conditions. The values for each of the emission related engine control

variables could be used by the Agency to evaluate that this regulatory requirement has been met.

– §86.007-21(o)(5) requires that manufacturers must submit the weighted brake-specific PM value from the test engine. This is necessary to compare against the SSS PM standard, and can be submitted electronically.

As discussed above, the data we are requiring in this final rule regarding the SSS standards are necessary for the Agency to be able to evaluate the manufacturers application for certification and make a determination that the engines meet the applicable requirements. The majority of this information can be submitted electronically, and would not be a significant increase in the reporting burden for manufacturers as suggested by the commenter.

We agree with the comments regarding the proposed regulatory requirement that manufacturers submit a statement that test results correspond to the maximum NOx-producing condition. This requirement could be interpreted to include ambient conditions outside the scope of the SSS. We have therefore changed the regulatory requirements for the final rule in response to the comments. The regulations now make it clear that the manufacturer must test the engine during the SSS with engine calibrations set to the maximum NOx-producing engine calibration which could occur under the conditions the engine is being tested, i.e., during standard laboratory conditions.

EMA and Detroit Diesel Corporation provided a list of detailed comments on the proposed SSS test procedure. The commenters correctly pointed out a number of errors and inconsistencies in the proposed SSS procedure. As discussed under Issue 9 (Supplemental Test Procedures) we have corrected all errors in the proposed SSS test procedure language, as well as provide clarification where needed.

We disagree with the comments from DDC that the SSS is redundant with the Agency's regulatory provisions regarding defeat devices and should be withdrawn. As discussed in the preamble for the proposal and this final rule, and as discussed above, the supplemental requirements (SSS and NTE) are both critical additions to the Agency's existing regulatory controls. Historically, EPA's approach to emission standard setting has been to set a numerical emission standard on a specified test procedure and rely on the prohibition of defeat devices to ensure in-use control over the range of operation not included in the test procedure. No single test procedure can cover all real world operation or conditions, particularly where certification is an engine-based test procedure rather than a vehicle-based procedure. For example, the same engine used in both a 9,000 pound and a 15,000 pound vehicle would likely see much higher speeds and loads, on average, in the 15,000 pound vehicle. The defeat device prohibition is designed to ensure that emissions controls are employed during real world operation and not just under laboratory or test procedure conditions. However, the defeat device prohibition is not a quantified numerical standard and does not have an associated test procedure. As a result, the defeat device definition is an imprecise tool to ensure that engines will operate with the same level of control in the real world as in the test cell. To ensure that emission standards are providing the intended benefits in use, the Agency must have a reasonable expectation that emissions under real world conditions reflect those measured on the test procedure. The supplemental exhaust emission standards and test procedures for HD diesel engines (the SSS and the NTE) are designed to supplement the current FTP standards and defeat device prohibition. It provides numerical standards and test procedures that cover additional modes of operation previously addressed by the defeat device prohibition. This

will help ensure that the standards are providing the intended benefits in actual use. Therefore, there is no redundancy between the SSS and the Agency's current regulations and policies regarding defeat devices.

COMMENT Q: Navistar International (Navistar) commented they could support the establishment of a "Euro III" test procedure and standard for HDDEs. Navistar commented that the Euro III, not the SSS proposed by EPA which is a modified version of the actual Euro III test, is technologically feasible and would fill any perceived testing gaps not covered by the existing transient HDDE FTP. **(Navistar International Transportation Corp. (IV-D-29))**

RESPONSE: As discussed in the response to Comment P under Issue 8.10 and in the responses to Comment R under Issue 8.11, we have made a number of changes to the proposed SSS test, and as finalized in this rule, the SSS is essentially identical to the Euro III test procedure in many respects.

Issue 8.11 Maximum Allowable Emission Limit Requirements

COMMENT R: EMA commented that EPA should eliminate the Maximum Allowable Emission Limits (MAEL) requirements from the final rule. EMA provides three principle reasons for there comment. First, EMA commented that the proposed MAEL requirement are unnecessary, unduly burdensome, and costly. As the basis for this comment, EMA points to the existing FTP standard, the proposed NTE and SSS standards, and comments that EPA has failed to justify the need for this additional requirement. Second, EMA comments that the MAEL compliance requirements lack clarity and are incapable of being understood. EMA provided a detailed list of comments on the proposed MAEL test procedure. An identical list of detailed comments on the proposed regulatory requirements was submitted by Detroit Diesel Corporation. Third, EMA commented the proposed MAEL unfairly imposes limits from a single certification engine to all engines in an engine family under any extreme ambient conditions and varied operation and test conditions. To support this comment, EMA discusses the proposed requirement that the data used to generate the MAEL be the SSS data collected at the time of certification on the certification engine, under steady-state conditions, and the MAEL generated from this data be applied to all engines within an engine family. EMA performed a statistical analysis of steady-state data generated by Southwest Research Institute for a HD fuels test program to comment that additional steady-state test points result in an increase in stringency. EMA also commented that the proposed MAEL could result in a failure for an engine rating within an engine family which met the FTP, the proposed NTE and SSS requirements, but did not meet the MAEL limits because the MAEL it must meet comes from a different rating within the engine family. DDC also commented that applying the same MAEL to all engines in an engine family was inappropriate, and DDC suggested that instead, the MAEL should be generated for each engine, from the SSS data generated on that same engine.

EMA also commented that the proposed 5 percent interpolation allowance for the MAEL limits is overly stringent and not sufficient. This comment was also made by DDC. DDC commented that EPA presented no data showing the feasibility of the 5 percent MAEL even for an engine certified to a 4 g/bhp-hr NOx standard. DDC commented further that the Euro III regulations, on which the MAEL is based, provides a 10 percent interpolation. DDC commented that if the MAEL is established by running the SSS test on each engine before compliance with that engines MAEL is determined, the allowance should be at least 10 percent.

DaimlerChrysler (DC) commented that the proposed linear interpolation method is not technically appropriate since linear interpolation has not yet been proven to be an accurate measure of HC, CO, and PM. DC commented that to assure accurate measurement, the measured pollutant value should be allowed to exceed the interpolated value by at least 10 percent.

DDC commented that the proposal to require compliance with the MAEL under transient operation is duplicative of the proposed NTE requirements, because they are both designed to ensure that emission maps in-use are flat and prevent unnecessary high emission spikes. DDC also commented the method by which transient MAEL compliance would be measured is unclear in the proposal. DDC recommends that the MAEL provisions be dropped from the final rule. DDC recommends that if the MAEL requirements are retained, they should only apply for steady-state operation, the 5% allowance should be increased, and the MAEL should not be based on the the certification SSS data, but should be uniquely established for each engine using the same test equipment and at the same ambient conditions used for MAEL compliance testing. DDC also commented the expanded ambient conditions and correction factor scheme proposed for MAEL testing are not appropriate.

EMA also commented that the proposal appears to apply MAELs to PM emissions, even though EPA did not propose a testing procedure for PM emissions under the MAEL procedures.

A number of the comments discussed above were also articulated by Navistar International Transportation Corp. Specifically, Navistar commented on the difficulties created by the proposed 5 percent interpolation allowance, the expanded conditions covered by the proposed MAEL, and the issues associated with applying a single MAEL surface generated by the certification engine to all engines within an engine family. Navistar would be willing to support an MAEL which was the same as the mystery point interpolation process in the actual Euro III test procedure, which incorporates a 10 percent allowance and would be set on an engine-by-engine basis.

(Engine Manufacturers Association (IV-D-05), Detroit Diesel Corporation (IV-D-28), **Navistar International Transportation Corp. (IV-D-29), DaimlerChrysler (IV-D-44))**

RESPONSE: We disagree with the comments that the MAEL requirements are unnecessary. However, we agree with a number of comments regarding the overall make-up of the MAEL requirements, and we have made a number of changes in response to these comments as discussed below.

The MAEL as proposed had two main goals. First, the MAEL was intended to ensure comparable emissions control for operating points other than the specified 13 modes. The SSS test consists of 13 pre-defined steady-state modes. EPA is concerned that without the “mystery points” manufacturers would only calibrate their engines to meet emission requirements at the specific 13 modes, and other steady-state modes could have much higher emissions. Therefore the proposed MAEL was used to generate an emissions limit for the operating points surrounding the SSS test points to ensure the surrounding test points were adequately controlled. This is equally true for the three “mystery points” on the SSS test and for independent testing of the surrounding points. The second purpose of the MAEL requirements as proposed was to enable EPA to determine compliance with the MAEL during actual on-road vehicle operation as well as laboratory testing. As proposed, this would be done by taking the 12 non-idle test points from the SSS test and using them to create an emissions surface through a mathematical interpolation process. Compliance with this

surface could then be tested in-use under steady-state or transient vehicle operation using appropriate emissions testing equipment.

In response to the comments, we have made a number of important changes to the MAEL final rule requirements. First, though the MAEL was proposed to be performed in the laboratory or in a vehicle during actual vehicle driving, this final rule establishes the MAEL as a laboratory only test, which can be performed under the same ambient conditions which apply to the pre-existing FTP and the SSS. The Agency believes the NTE requirements will provide a sufficient and a more practicable in-use compliance tool as compared to the MAEL. The NTE requirements cover a broader range of engine operation than the MAEL, as well as a broader range of temperature and humidity without correction factors. The NTE control zone covers a larger area of the engine map than the MAEL control area. Therefore, the NTE will cover a broader range of vehicle operation. The MAEL was proposed to cover the temperature range between 68F and 86F with no correction factors, but with correction factors for NOx and PM outside this range. The NTE, on the other hand, covers a temperature range from 55F to 95F with no correction factors (or under the NTE temperature condition option two, from 55F to 100F with no correction factors at sea-level, and from 55F to 86F at 5,500 feet above sea-level). In addition, as discussed in more detail below, the MAEL does not include a PM limit, while the NTE has a PM standard of 1.25 times the FTP standard. Finally, during in-use testing, compliance with an MAEL as proposed would require sophisticated post-test data processing to determine if an engine exceeded the MAEL, since the MAEL is not a single value but is determined for each operating point by an interpolation process. However, the NTE is relatively simple to determine compliance with, since the NTE standard is 1.25 times the FTP standard. For all of these reasons, the broader engine operating and ambient condition provisions covered by the NTE, the lack of a PM standard for the MAEL, which is covered by the NTE, and the ease of implementation of the NTE compared to the MAEL, we have removed the on-road testing component of the MAEL from the final rule, and compliance with the MAEL will be based on laboratory testing under standard FTP laboratory conditions.

Regarding the comments on transient testing, the FRM establishes the MAEL as a laboratory only test. Transient engine operation was necessary for the proposed MAEL to enable in-use, on-road testing of an engine to determine compliance with the MAEL, because truly steady-state operation is difficult if not impossible to achieve during on the road driving, therefore in-use compliance testing of the MAEL would require that transient operation be part of the MAEL standard. However, because the final rule does not contain an on-road MAEL standard, transient engine operation does not need to be part of the MAEL. Therefore, the transient testing component of the MAEL in the proposal is no longer needed, and the final rule removes transient testing from the MAEL.

Though the NTE can provide an effective means to enable on-road, in-use testing of HDDEs, the remaining principle goal of the MAEL continues to be an important part of the Agency's HDDE emission control program, i.e., ensuring that the emission controls used during the SSS test continue to operate effectively for steady-state operation near the individual test modes which make up the SSS. For this reason we are finalizing the MAEL interpolation process contained in the proposal, as well as the Agency's ability to select up to 3 mystery points at the time of certification to check compliance with the MAEL steady-state interpolation emission limits. As discussed under Issue 9 (Supplemental Test Procedures), we have corrected all errors in the proposed MAEL test language, and provided additional clarification where necessary.

EMA correctly pointed out that the proposed regulatory test procedure language appeared to indicate PM limits apply to the MAEL, though the proposed preamble did not discuss an MAEL PM standard. The proposed regulatory language was unclear on this issue. Specifically, in the proposed §86.004-11(a)(3)(ii) we stated that "Exhaust emissions shall not exceed the Maximum Allowable Emission Limits ...." (emphasis added). This requirement implies all exhaust emissions, which would include PM. Also, in the proposed §86.1361-2004(c)(3), we discussed correction factors for PM emissions collected during compliance testing of the MAEL. However, in the proposed §86.1360(f)(1), we stated that "For gaseous emissions, the 12 non-idle test points ..... shall define the Maximum Allowable Emission Limits for the purposes of §86.004-11(a)(3)." This statement correctly identifies the gaseous emissions as defining the MAEL, not particulate matter. We did not intend to propose PM standards for the MAEL, and the final rule clarifies that no PM limits apply to the MAEL and the mystery-point checks. The SSS testing requirements for PM require that a single pair of PM filters is used for the 13-mode test, the result is a single, time weighted PM sample (i.e., one pair of filters, and a single data point). Compliance with the "mystery points" and the MAEL requires an interpolation process defined in the regulations, and four data points, from the surrounding four steady-state test modes, supply the data for the interpolation process. However, for PM, there are no surrounding data points, since the test produces only a single PM sample and data point. Therefore, it is not possible to have an MAEL or mystery point requirement for PM. This has been reflected in the regulations for this final rule. Specifically

- §86.2007-11(a)(3)(ii) which defines the MAEL standard has been modified to state that gaseous emissions shall not exceed the MAEL

- The following sentences regarding the mystery points have been added to §86.1360-2007(b)(2), "Emissions sampling for the additional test modes must include all regulated gaseous pollutants. Particulate matter does not need to be measured."

- The discussion regarding PM correction factors for MAEL in-use compliance which was in the proposed §86.1361-2004 has been deleted

We agree with the comments that utilizing the MAEL surface generated from the SSS test data from a single certification engine for all engines in an engine family is unnecessarily restrictive in order to check compliance with EPA selected mystery points, and we have removed this provision from the final rule. As described in the regulatory language for this final rule, an engine would be compared to the MAEL emission limits through an interpolation process using the SSS test data from that same engine, not from other engines in the engine family.

Regarding the comments from EMA on the increased stringency from additional steady-state test points and their analysis of test data from a test program at Southwest Research Institute. As discussed in response to comment C under Issue 8.3, the intent of comments regarding "increased" stringency is unclear. As promulgated in this final rule, the 2007 standards, including the MAEL requirements, are technologically feasible and appropriate under the CAA.

In addition, several manufacturers commented that the proposed 5 percent allowance (i.e., an engine's emissions at each mystery point can be no greater than 5 percent of the value determined by interpolation from the surround SSS test points) was overly restrictive, and some manufacturers suggested a value of 10 percent. We agree with these comments, and the final rule contains a 10 percent interpolation value. As discussed in a technical memorandum to the rulemaking docket, a number of engine manufacturers comply with a Euro-3 emission limit of 4

g/bhp-hr NOx for certain HD diesel engines produced today, and these engines comply with a MAEL interpolation allowance of 5 percent, which at an emission limit of 4 g/bhp-hr NOx translates into an additional allowance of 0.2 g/bhp-hr. The 2004 HDDE NMHC+NOx standard will result in engines with approximately a 2 g/bhp-hr NOx emission level. An interpolation allowance of 0.2 g/bhp-hr NOx, i.e., 10 percent, will be sufficient to ensure that engine manufacturers are applying the same level of steady-state emission control to areas surrounding the SSS steady-state points as is applied to the actual steady-state test points which comprise the SSS test procedure. We disagree with the comment from DaimlerChrysler that the linear interpolation method is not appropriate for HC and CO, as it applies in this final rule. The linear interpolation method contained in this final rule is the same method used by the Europeans in their heavy-duty Euro-III test procedure. The interpolation method is used to constrain the test points surrounding the 12 non-idle SSS test points to be within 10 percent of an interpolated value, and linear interpolation is a reasonable means by which to constrain these emissions. A number of HD engine manufacturers, as a result of their obligations on their consent decrees signed with the Agency in 1998 are certifying HDDE today which utilize the linear interpolation method contained in this final rule for HC and CO, as well as for NOx to show compliance with EPA selected "mystery points".[20] These manufacturers have demonstrated with their certification data that the linear interpolation method will work for HC, CO and NOx emissions.

One commenter suggested linear interpolation was not appropriate for PM. We do not agree or disagree with this comment. As discussed previously in this section, we did not intend to propose and this final rule does not contain any interpolation method for PM. This rule does not establish an MAEL PM standard.

EMA commented that the MAEL are unduly burdensome and costly. We disagree with this comment. As discussed above, we have made significant changes to the MAEL requirements in response to the comments we received. The MAEL is no longer a transient test, it can be tested against only in the laboratory. Each engine's SSS data is used to create that engine's MAEL, and the interpolation method includes a 10 percent cushion. With these changes, there is very little additional costs of the MAEL. The manufacturers will simply need to perform modest additional steady-state engine testing to ensure that the emission control strategies they develop to comply with the SSS continue to function adequately in between the 12 non-idle SSS test points.

Issue 8.12 Supplemental Requirements and the Potential Impact on the Cooling Capacity for HD Trucks

COMMENT S: The Truck Manufacturers Association (TMA) commented that they are concerned with the technical feasibility of the proposed additional test requirements for model year 2004 HD diesel engines. TMA commented that the proposal does not include provisions for the use of a high temperature protection system. TMA commented there is value in having an auxiliary emission control device (AECD) for high temperature protection because it would reduce the need for oversize radiators which would affect vehicle aerodynamics and hence fuel economy and vehicle visibility. TMA commented that current prototype 2002 HDDEs have increased heat rejections

[20] See EPA Memorandum to EPA Air Docket A-98-32 titled "Summary of Model Year 1999 and 2000 Federal On-highway Heavy-duty Diesel Engine Families Certified as Compliant with Not-to-Exceed Requirements, Euro-3 Steady State Requirements, and Maximum Allowable Emission Limits Requirements".

requirements between 20 and 40 percent, and more for some power ratings. TMA suggests a high temperature protection strategy which would require the cooling system to provide cooling sufficient for the conditions of 75 percent load and 100 deg. F at sea level. For heat rejections higher than the equivalent of this engine condition, an AECD would be allowed. TMA included an analysis of the impact of the requested AECD on HD vehicle cooling systems and the potential increase in emissions due to changes in vehicle frontal area. **(Truck Manufacturers Association (IV-D-39))**

RESPONSE: We understand that TMA members are concerned regarding the potential negative impacts of large increases in heat rejection on the cooling system capacity of HD vehicles. TMA's comments are directed at the supplemental standards, which while proposed for model year 2004 have been finalized for model year 2007. Therefore, TMA members and engine manufacturers have almost 7 full model years to optimize HDDEs to lower heat rejection and to consider improvements in cooling systems for HD vehicles that would not require the redesign of vehicle frontal areas. In the event not all HD vehicles are able to accommodate the HD diesel engine designs in the 2007 time frame, than those vehicles may need to make changes to the vehicle's cooling system, which may require changes in vehicle frontal areas if other improvements in vehicle cooling systems can not be made. However, this is not a technological feasibility issue for the 2007 standards, but instead is a cost issue. As discussed below, we do not expect that significant redesigns of vehicle frontal area will be required for MY2007, and to the extent they are, we believe any redesigns would be limited to the highest power rating engines.

It is important to note that TMA's suggested solution would not be employed until relatively high temperature and load conditions (75 percent load and 100 deg. F at sea level). Also, according to TMA, the cooling problem and therefore the proposed solution is not anticipated to be required for all engines-truck combinations, only those with the highest heat rejection and worst cooling system issues. As discussed previously, the NTE requirements contained in today's final rule establish upper bounds for temperature and altitude compliance, and the conditions for which TMA has requested an AECD are during engine operation which is near or outside of these upper bounds. These conditions likely represent a minimal amount of operation. It is therefore reasonable to expect that improvements in engine and vehicle designs between now and 2007 will negate the need for the provisions TMA has requested.

TMA states that current prototypes engines being designed for 2002 introduction under the HD diesel consent decrees have an increased heat rejection in the 20 to 40 percent range, and higher for some power ratings. Because of the potential impact on vehicle design and fan-on time, engine manufacturers have a strong incentive to maintain the heat rejection of the engine system within the capabilities of the existing vehicle cooling systems, and to minimize the heat rejection of the vehicle to minimize fan-on time. Fan-on time requires additional power output from the engine which results in increased fuel consumption and no useful work.

Thus, manufacturers will have an incentive to lower the heat rejection of their 2002 and later engines, and the heat rejection of the production engines may be lower than the pre-production prototypes TMA members currently have experience with. Those engine manufacturers who must meet consent decree requirements for the 2002 pull ahead have had limited time to design their prototypes which TMA members have experience with. The HD consent decrees were signed in October of 1998, and the proposal for this rulemaking was published in October of 1999. It is therefore likely that the CD company engines which TMA members have had experience with thus far have been on an accelerated development schedule, perhaps less than one year. The principle reason for increased heat rejection to the vehicle cooling system from 2004 technology HD diesel

engines is the use of cooled EGR, and manufacturers will have an additional seven years to fine tune their use of cooled EGR in order to reduce overall heat rejection.

In addition, the market place will drive HD engine manufacturers towards engine designs which fit within the constraints of the intended vehicles' cooling capacity. The structure of the HD vehicle market in the U.S. treats HD engines as a commodity, i.e., vehicle manufacturers have a range of engines from different engine manufacturers to choose from. For example, it is typical for a HD vehicle manufacturer to offer engine models from multiple engine manufacturers in the exact same HD vehicle, so a vehicle manufacturer can choose between two or more HD engines when offering a vehicle for sale.[21] Therefore, competition among engine manufacturers will drive them to maintain the engine's heat rejection within the capacity of the intended vehicle. TMA indicates vehicle manufacturers may have difficulties with engine heat capacity in the 2002 time frame due to the HD consent decrees, and they are concerned with the impact of the supplemental standards on vehicle designs. We expect improvements in engine designs as well as in vehicle cooling systems will occur between now and 2007, and no major changes in vehicle frontal areas will be needed. Opportunities for improvement can be found in many areas, e.g. engine manufacturers will gain experience in optimizing their use of cooled EGR to minimize the quantity of EGR necessary to comply with the emission standards, which will reduce the system heat rejection to the cooling system, and vehicle manufacturers will consider optimized cooling system location, improved materials, and other design changes, including innovative technologies such as variable speed fans, all of which can increase the cooling systems capacity to handle higher heat load from the engine without the need to change vehicle frontal area designs.

We have not included a detailed review or an assessment of the analysis provided by TMA regarding the potential relationship between cooling systems, heat rejection, frontal area, aerodynamic drag, fuel economy and emissions because there was not sufficient information provided in the comments to perform a detailed assessment.
The TMA analysis was developed on data which was not provided in their comments. The example calculation performed TMA uses an example increased load of 15 horsepower due to an increase in fan on time, but the basis for such an increase is not provided - only a hypothetical analysis is provided. The analysis by TMA does not address the feasiblity of the 2007 requirements because it is premised on 2002 prototype engines. It is reasonable to expect the HD engine industry will reduce heat rejection load on the vehicle cooling system and for vehicle manufacturers to make improvements to cooling system performance to improve fuel economy between now and model year 2007 implementation of the supplemental requirements. It is also expected the relationship between cooling system, heat rejection, frontal area, and emissions will change but in ways that cannot now be numerically predicted.

TMA has suggested a solution to the issues they have raised would be an AECD provision placed in the regulations. Adopting such a provision in the regulations at this time would be a potential barrier to improvements in HD engine systems and HD vehicle cooling systems. As discussed above, appropriate market incentives are already in place to drive HD engine and vehicle manufacturers towards designs which will achieve low emissions, lower engine system heat rejection, improved vehicle cooling systems, and better fuel economy, and it would not be

[21] See Memorandum to EPA Air Docket A-98-32, "Example Product Information on HD Vehicles in the U.S."

appropriate for EPA to hinder these incentives. As discussed above, there are various avenues for technical progress over the next several years that can reasonable be expected to address TMA's concern, without the need for the requested regulatory provision.

Issue 8.13 Cost, Energy, and Safety Factors Associated with Supplemental Requirements

COMMENT T: Navistar International commented that the Agency failed to examine the cost, energy and safety factors associated with the proposed supplemental requirements, which is required by the EPA under the Clean Air Act. **(Navistar International Transportation Corp. (IV-D-29))**

RESPONSE: We disagree with this comment. We stated both in the proposal and in this final rule that the technologies which will be used by engine manufacturers to comply with the 2004 FTP emission standards are capable of achieving the supplemental standards contained in this final rule. The technological feasibility analysis and cost analysis included in this final rule includes the costs and technologies necessary to comply with the supplemental standards, as well as the costs associated with the load response test. The technologies which will be used by manufacturers (principally cooled EGR, advanced turbochargers, advanced fuel injection systems and electronic controls), will not present any new safety issues for engine manufacturers, and this issue was addressed in the 1997 FRM, which included an assessment of all of these technologies. In addition, our final rule included an examination of the potential effects of these standards on fuel economy (i.e., energy), and our conclusion that no decrease in fuel economy for HDDE will occur because of these new standards. Additional responses to the comments we received on the costs of our proposal for this final rule can be found under Issue 6.

Issue 8.14 Selective Enforcement Audits

COMMENT U: Both Detroit Diesel Corporation (DDC) and the Engine Manufacturers Association (EMA) expressed uncertainty as to whether the SSS, NTE, and LRT tests are to be conducted during Selective Enforcement Audits (SEA). Both organizations commented that EPA should exclude all supplemental tests from SEA testing because they will significantly increase the manufacturer's burden of SEA testing. EMA attributed the extra burden to an increased risk of SEA failure posed by what it considers the requirement to comply under a potentially infinite number of testing points and conditions associated with the NTE and MAEL. EMA believes that, in light of expected normal production variability, manufacturer risk is further increased because the MAEL surface is derived from a single certification engine. EMA commented that EPA must ensure the supplemental tests do not increase the manufacturer risk beyond that associated with the existing 40% Acceptable Quality Limit (AQL) provisions.

Both EMA and DDC commented that if supplemental tests are to be conducted during an SEA, more information is needed in 40 CFR Part 86, Subpart K on how to conduct the tests and demonstrate compliance. DDC listed specific protocol issues which it believes must be resolved prior to conducting the supplemental requirements during SEAs:

- What ambient conditions will be used for the SSS, NTE, MAEL, and load response tests? Will the same set of ambient conditions be used for each engine tested?
- Will manufacturers be required to run 3 EPA-selected test modes in addition to the 13 mode SSS? Will the same 3 EPA-selected modes be used for each engine tested?

- How many test modes will be run to determine compliance with MAEL requirements?
- How many test modes will be required to determine compliance with NTE requirements? Will these be the same test modes used for evaluation of MAEL compliance?
- Will conformance with the MAEL and NTE requirements need to be demonstrated transiently? If so, how are the transient tests to be run?
- Are the MAEL limits for each engine determined by the 13 mode SSS testing done on each engine in turn, or are they referenced to the SSS test done on the certification engine for the relevant engine family?
- Does the NTE and MAEL testing done on each audit engine result in a single NTE and MAEL pass/fail decision for each engine for each emission constituent or is a separate pass/fail decision made for each NTE/MAEL test mode? If a separate pass/fail decision is made for each test mode, is the audit pass/fail decision based on the results from the corresponding test modes run on each individual engine?
- Are particulate results required for each of the NTE and MAEL test modes?
- If load response testing is required, more explicit procedures are required for running the load response test, and limits and procedures are needed for making load response pass/fail decisions.

Both organizations further commented that to the extent EPA includes the proposed supplemental tests during SEA testing, EPA must propose new language in 40 CFR Part 86, subpart K to address the above concerns and provide an opportunity for public review and comment on any new proposed language. **(Detroit Diesel Corporation (IV-D-28), Engine Manufacturers Association (IV-D-05))**

RESPONSE: Paragraph 86.1008-90(a)(1)(i) of subpart K provides the Agency with the authority to conduct the SSS, NTE, MAEL and LRT tests as described in subpart N during an SEA. However, we agree with DDC's comment that the supplemental tests will increase the time and cost associated with conducting an SEA. The goal of SEA is to ensure the compliance margins demonstrated by prototype engines during certification are sufficient to account for production line variability when the engines are mass produced. We believe this goal can be achieved with by the addition of the SSS test to the SEA program beginning in model year 2007, but as discussed below, we do not believe the NTE, MAEL, LRT, or the SSS mystery points (i.e., the steady-state testing points which fall within the SSS steady-state control area which EPA can select to determine compliance with the Maximum Allowable Emission Limits), are needed at this time as part of the SEA program.

We believe there are number of reasons why that goal can be achieved without having manufacturers conduct the NTE, LRT tests, or the SSS mystery points. First, SSS mystery points and the MAEL allow the Agency to evaluate the appropriateness of engine calibrations at operating modes in between the defined SSS steady-state points. We believe the mystery point data generated during certification provide sufficient insight as to the appropriateness of non-SSS steady-state calibrations. Second, the LRT test is not a compliance test at this time, but rather a data-gathering procedure. Hence, there is no standard which can be tested against during a SEA. For these reasons, we have removed SSS mystery point testing, MAEL testing, and LRT testing from the SEA regulations in this final rule (See 86.1008 in regulations for this final rule)

Finally, one of the purposes of the NTE test is to enhance the Agency's ability to perform in-use compliance verification. EMA has agreed to work with the Agency towards the development of a meaningful in-use testing program (See the letter from Mr. Jed Mandel, Neal, Gerber & Eisenberg, to Ms. Margo Oge, Office of Mobile Sources, July 1, 1999, available in the public docket for this rule, and see the response to comment A under Issue 27 in this document). To the extent that an in-use program is in place, we believe it is unnecessary to include the NTE as part of the SEA testing protocol. For these reasons, we have removed NTE testing from the SEA regulations in this final rule (See 86.1008 in regulations for this final rule). In the absence of an in-use program, it may be necessary to conduct NTE testing during SEAs as an alternative to an in-use testing program. However, the Agency would need to go through a rulemaking process in order to require NTE testing as part of the SEA program in the future.

For these reasons, manufacturers will be required to conduct only the transient FTP and the SSS test during SEAs. The SSS test consists of a prescribed duty-cycle conducted under the same laboratory conditions as the existing transient FTP. Therefore, adding the SSS test to the SEA protocol does not require any changes to subpart K. In response to DDC's questions on the ambient conditions associated with the SSS test, the conditions under which the SSS test is to be performed are specified in the regulations in this final rule in §86.1360-2007, paragraph (i), which specifies the same conditions as are currently applicable to the existing transient HDDE FTP. Therefore, the SSS test will be conducted under the same laboratory conditions applicable to the existing transient FTP, and thus the variation in ambient conditions between SSS tests will be similar to transient FTP test variation. We are not addressing the remainder of DDC's listed questions and concerns, because they were directed at the NTE, LRT, MAEL and SSS mystery points which are not required components of an SEA at this time.

Issue 8.15 Issues Regarding Compressed Natural Gas Engines

COMMENT V: The supplemental test procedures should not be applied to compressed natural gas (CNG) engines. **(Engine Manufacturers Association (IV-D-05), Deere & Company (IV-D-64))** Feasibility of supplemental requirements has not been demonstrated for CNG engines; these requirements should be deferred until additional information regarding feasibility and appropriateness is obtained. **(Engine Manufacturers Association (IV-D-05), Deere & Company (IV-D-64), Detroit Diesel Corporation (IV-D-28))** Supplemental test procedures are not appropriate or necessary in the case of CNG engines; these tests are intended to remedy non-compliance by diesel-fueled engines. EPA should exempt CNG engines from the supplemental tests, or in the alternative, provide manufacturers of CNG engines with testing waivers. **(Natural Gas Vehicle Coalition (IV-D-76)** The additional testing and compliance burden of EPA's proposed rule makes it difficult to justify the continued development and production of low volume CNG engines. **(Deere & Company (IV-D-64), Detroit Diesel Corporation (IV-D-28))**

RESPONSE: We disagree with commenters that suggest that the supplemental tests are intended to remedy non-compliance by diesel-fueled engines. That was the purpose of the consent decrees, not the proposed regulations. The proposed supplemental requirements are intended to ensure compliance of heavy-duty diesel engines with the applicable emission standards across a broad range of operating conditions. The need for such assurance is as necessary for natural gas engines as for diesel engines. Consequently, we believe that it is appropriate to apply the supplemental tests to heavy-duty CNG engines that are derived from a diesel-cycle diesel-fueled engine. Indeed, the diesel-cycle diesel-fueled engine upon which the CNG engines are based will be certified to all

applicable standards, including the supplemental test requirements, and it is difficult to imagine that it makes sense to permit modifications to that engine allowing it to run on a different fuel if those modifications result in an engine that does not have to meet a set of standards as stringent as the unmodified base engine. In addition, we do not believe that feasibility must be demonstrated for all conceivable modifications to diesel-cycle engines that a manufacturer may make to permit operation on different fuels. We have adequately demonstrated that the supplemental tests are feasible for the diesel-cycle engines upon which the CNG engines are typically based, and should those engines be modified to run on different fuels we believe that they should continue to meet all originally applicable requirements. The decision of manufacturers to build CNG engines is a market-driven choice and such engines are not necessary to meet the general need for heavy-duty engines. EPA should not sacrifice emission control to satisfy this manufacturer choice. Moreover, manufacturers of CNG vehicles are permitted to petition EPA to exclude points of the NTE area if the engine is not expected to operate in such areas in normal operation. Further, CNG engines today are incredibly clean; most are already easily meeting the 2004 FTP emission limits, and seven years of lead time is more than sufficient for manufacturers to extend the type of control already existing on the FTP to a wider area of operation (indeed, a high level of control over a broad range of operation may already exist for many of these CNG engines). In fact, CNG vehicles are generally promoted as cleaner than diesel vehicles. This is a prime reason for their attractiveness to certain consumers. Excluding CNG vehicles from emission requirements would actually reduce the assurance of environmental benefit that make CNG vehicles attractive to these consumers. While we do not believe that the burden of the new compliance requirements is significant enough to impact the manufacturers market-based decision to offer heavy-duty CNG engines, it is ultimately the manufacturers choice whether or not to market such engines. As noted above, there is no fundamental requirement that necessitates the production of heavy-duty CNG engines.

COMMENT W: EPA's proposed regulation does not clearly state whether EPA's policy regarding the classification of a CNG engine as a diesel engine if it was derived from a diesel engine even if uses a throttle will continue. It is therefore unclear whether the diesel or Otto-cycle provisions of the proposed rule are intended to apply to a given CNG engine. **(Detroit Diesel Corporation (IV-D-01, IV-D-28), Natural Gas Vehicle Coalition (IV-D-76)**

RESPONSE: We established emission standards for light-duty vehicles, light-duty trucks, heavy-duty engines and vehicles, and motorcycles fueled by natural gas and liquified petroleum gas in a 1994 final rule (59 FR 48472, September 21, 1994). In that rule we clarified how a gaseous-fueled engine should be classified with the following paragraph:

> Although there are other factors to consider, in general an Otto-cycle engine is considered to be one that is throttled during normal operation whereas a diesel is not. The Agency recognizes, however, that in some cases this criterion may not be adequate or appropriate to determine a vehicle's classification. For example, a gaseous-fueled engine which is derived from a particular Otto-cycle or diesel base engine, and is expected to be used in similar applications as the base engine, would most appropriately be classified the same as the base engine from which it was derived. In such cases the Administrator will take into account other relevant factors, such as compression ratio, combustion and thermodynamic characteristics, or intended in-use duty cycle when classifying the vehicle. (59 FR 48476)

Although our proposed rule that elicited the comments regarding this issue did not explicitly mention or reiterate this policy of classifying gaseous-fueled engines, the omission was not intended to

indicate a departure from treating gaseous-fueled engines in this way. In fact, by not proposing to change the policies or provisions established in the 1994 gaseous-fueled vehicle and engine rulemaking, the expectation is that those policies and provisions will be maintained. Consequently, to the extent that EPA is currently classifying natural gas engines as diesel cycle engines, even though they are spark-ignited, manufacturers must meet this classification in the context of the new heavy-duty vehicle and engine emission standards. As always, manufacturers with questions about how to classify a particular engine should contact the EPA.

Issue 8.16 Global Harmonization of Emission Testing Protocols

COMMENT X: EPA's proposal should be considered in the broader context of developing harmonized worldwide solutions that accurately reflect in-use operation. EPA should participate in the World Heavy Duty Certification work program of the United Nations Economic Commission for Europe. EPA's proposal of complicated test procedures that differ from the rest of the world is detrimental to the global harmonization effort, therefore EPA should withdraw the proposed rule and give adequate consideration to global harmonization of emission standards and test procedures. **(DaimlerChrysler (IV-D-44))**

RESPONSE: As noted in the response to Comment B, below, EPA's adoption of the steady-state test is a step towards harmonization with the European certification protocols. We are aware of the progress that the World Heavy Duty Certification work program is making towards developing on-highway heavy-duty test protocols, and we will continue to provide input into that process as appropriate. However, it will be some time before a complete program emerges from the European process. We do not believe that it would be appropriate at this time to delay implementation of important elements of a federal heavy-duty compliance program. We will continue to monitor the progress in Europe, and it remains a possibility that we will investigate and pursue the adoption of test protocols that are more fully harmonized with European requirements in the future. It is also possible that the process underway in Europe will conclude with regulations that are harmonized with the regulations promulgated in this rule.

COMMENT Y: Adoption of the proposed 13-mode steady state test represents a positive step towards the international harmonization of standards as this procedure is consistent in many respects with the European EURO III ESC test. **(American Petroleum Institute (IV-D-23))**

RESPONSE: We agree with this assessment. The steady-state test that we are finalizing is similar, although not totally identical to, the European steady-state test noted by the commenter. The federal and European tests are very compatible, and manufacturers should be able to run a single test that generates test results and data suitable for meeting both the federal and European requirements.

ISSUE 9: SUPPLEMENTAL TEST PROCEDURES

Comment A: EMA commented that EPA's proposed NTE test procedures are unclear. EMA commented that the test procedures proposed by EPA cannot be understood or complied with by engine manufacturers. EMA provides two sections of the proposed regulatory test procedure discussion as examples. EMA states that EPA must provide language which is understandable and free from ambiguity and uncertainty. **(Engine Manufacturers Association (IV-D-05))**

Response: The comment seems to confuse the simplicity of the test procedure with a lack of

clarity. The regulations are clear. When operated within the NTE zone, emissions shall not exceed the applicable NTE limits when averaged over 30 seconds or longer. Though this is different than the more specified test schedule with the existing FTP, it is clear in its meaning.

We agree that there were a number of errors in the proposed regulatory test procedure, and as discussed below, we have corrected these errors in the final rule.

COMMENT B: Manufacturers made several detailed comments on the proposed regulatory text for the supplemental test procedures. Below is a list of their comments.

§86.1360-2004 supplemental steady-state test procedures	- Clarify if supplemental tests are included in SEA testing. - Paragraph (c)(2) is inconsistent with (c)(1) in defining A, B, & C speeds. - Torque/speed ratios in (c)(1) are not applicable to power calculations. - Paragraph (d) is inconsistent with (f)(1) in defining the control area. - The reference to §86.1332-90(d)(3) for engine warm up in paragraph (e)(2) is not specific enough. - Paragraph (e)(4)(ii) is inconsistent with (e)(2) for the timing of the measurements at the EPA selected points after the 13 mode test. - The references to §86.1340 and §86.1342 for calculation formulas and procedures in paragraphs (e) and (g) are not specific enough. - The formula in paragraph (e)(5) for calculating weighted 13 mode gaseous emissions is incorrect and the PM formula is omitted. - Paragraph (f)(1) is inconsistent with (f)(3) in defining the MAEL. - Clarify that MAEL interpolation factor would be allowed if the weighted emissions were equal to the standard. - The equation for M_{RS} in paragraph (g)(2) includes an undefined factor E. - The purpose of the X_{diff} parameter in paragraph (g)(3) is unclear. - "Brake specific" should be used in place of "specific." - Provide more description of test fuel, ambient conditions, intake and exhaust restrictions, charge cooling specifications and other parameters.
§86.1361-2004 MAEL for compliance in actual operation	- Manufacturers commented MAEL test procedure language need to be clarified in several sections. - (These comments are no longer an issue because we are not finalizing the MAEL test for compliance in actual operation.)
§86.1370-2004 NTE test procedures	- The NTE lower speed boundary equation $n_{lo}+ 0.15 n_{h i}(n_{hi}-n_{lo})$ in paragraph (b)(1) yields speeds greater than the maximum speed of any heavy-duty engine and needs to be corrected. - The test conditions for evaluating BSFC need to be specified in paragraph (b)(3). - Paragraph (b)(5) references a nonexistent paragraph 86.1350(c). - Add procedures for computing average emissions over the 30 second time period described in paragraph (d)(1).
§86.1372-2004 measuring smoke emissions in the NTE zone	- This section needs to specify test procedures, ambient test conditions and corrections, engine operating conditions, and other factors to adequately define measurement techniques. - Paragraphs (b) and (c) need to clarify when alternative equipment is allowed. - Paragraph (d) needs to clarify what is meant by a valid test. - Paragraph (e) needs to specify a smoke measurement averaging procedure.
§86.1380-2004 load response test	- The five speeds identified in paragraph (b)(1) need to be corrected so that they are not identical. - This section needs to specify parameters to be measured, ambient test conditions, measurement equipment, operating cycle, engine set-up, fuel, engine warm-up, speed

tolerances, and calculation procedures.
- The reference to §86.1340 and §86.1342 for calculation formulas and procedures in paragraph (b)(3) is not specific enough.

(Engine Manufacturers Association (IV-D-05), Detroit Diesel Corporation (IV-D-28))

RESPONSE: The manufacturers comments were helpful in our review of the regulatory text. Many of these comments pointed out errors or text that needed clarification. We provided manufacturers with an updated version prior to the final rule in which a number of the issues were resolved. We also placed this interim version of the regulatory text in the docket (II-C-01). The changes we made are listed below:

§86.1360-2004 We removed paragraph (c)(2) which was inconsistent with paragraph (c)(1). We removed the reference to torque/speed ratios because they are not needed for the power calculation. We revised paragraph (d) to be consistent with paragraph (f)(1) in defining the control area. We made the reference to warm-up procedures more specific by referencing section 86.1332-90(d)(3)(i) through (iv). We removed the inconsistent language in paragraph (e)(4)(ii). We corrected the weighted emission formula in paragraph(e)(5) to correctly consider that idle emissions are infinite on a brake-specific basis. We revised paragraph (f)(1) to note the exception in (f)(3). We clarified that the MAEL interpolation factor would be allowed if the weighted emissions were equal to the standard. We defined the factor E and removed the factor X_{diff}.

§86.1370-2004 We corrected the equation in paragraph by removing the first "n_{hi}" which was incorrectly included in the equation. We added text that states the BSFC is to be calculated under the conditions specified in section 86.1330. The reference in (b)(5) to section 86.1350(c) has been corrected to 86.1360(c).

§86.1372-2004 We revised paragraph (e) to require a sampling frequency of at least 1 Hertz.

§86.1380-2004 We corrected the list of speeds in paragraphs (b)(1)(i)-(iv). We provided more detail on the specifications for the test procedure including ambient test conditions, measurement equipment, operating cycle, engine set-up, fuel, engine warm-up, and calculation procedures.

COMMENT C: After reviewing our interim version of the regulatory text, Detroit Diesel, speaking for EMA, submitted comment on this text. Detroit Diesel commented that they were satisfied with our response to many of their comments on the supplemental test procedures text. However, they pointed out several issues that they considered to be unresolved. These issues are listed below.

§86.1360-2004 supplemental steady-state test procedures	- Clarify if supplemental tests are included in SEA testing. - The references to §86.1340 and §86.1342 for calculation formulas and procedures in paragraphs (e) and (g) are not specific enough. - "Brake specific" should be used in place of "specific." - Provide more description of test fuel, ambient conditions, intake and exhaust restrictions, charge cooling specifications and other parameters.
§86.1370-2004 NTE test procedures	- Add procedures for computing average PM emissions over periods as short as 30 seconds as described in paragraph (d)(1).

§86.1372-2004 measuring smoke emissions in the NTE zone	- Paragraph (a)(1) specifies a five inch optical path length which is different from Subpart I which specifies optical path length as a function of engine power. - This subpart needs to specify test procedures, ambient test conditions and corrections, engine operating conditions, and other factors to adequately define measurement techniques. - Paragraphs (b) and (c) need to clarify when alternative equipment is allowed. - Paragraph (d) needs to clarify what is meant by a valid test.
§86.1380-2004 load response test	- This section needs to specify if PM carve-out is included, speed tolerances, time periods for sampling, and phase alignments. - The reference to §86.1340 and §86.1342 for calculation formulas and procedures in paragraph (b)(3) is not specific enough.

(Detroit Diesel Corporation (IV-G-01))

RESPONSE: We believe that we appropriately addressed the remaining comments in our final regulatory text. The following paragraphs discuss our response to the comments on the four sections listed above.

§86.1360-2004 For our response to the applicability of the supplemental test procedures to SEA testing, see the discussion under Issue 8.14. We intend the calculations for the supplemental test procedures to be consistent with other calculations in Subpart N. For this reason we refer to sections 86.1340 and 86.1342 in when describing calculation formulas and procedures. We modified our draft language to specify that only the g/hr calculations are applicable and we include a formula in this section 86.1360 for calculating the weighted average emissions. We modified the text to use the term “brake-specific.” We include text that refers to the appropriate sections of Subpart N to specify fuel and other general requirements.

§86.1370-2004 The particulate sampling procedures in Subpart N that are currently used for heavy-duty engine testing can be used to sample particulate over periods as short as 30 seconds. In addition, PM measurement capabilities have progressed substantially in recent years. The use of such new equipment and measurement methods is allowed under section 86.1310(a)(10) with prior approval by the Administrator if such equipment is shown to yield equivalent results to the equipment and methodologies specified in subpart N. This is discussed in detail under Issue 8.

§86.1372-2004 We use a five inch effective optical path length to create a smoke standard that is equivalent for all engines. Where Subpart I focuses solely on opacity, the NTE smoke standards are a smoke “density” standard. The same ambient conditions apply for the smoke test as for the NTE zone. This is specifically stated in section 86.007-11 (a)(4)(ii). The final regulatory text allows other equipment may be used if the manufacturer so chooses if it is approved in advance by EPA. Paragraphs (a) through (c) define a valid test.

§86.1380-2004 We clarified the language to show that the load response test applies to the whole NTE zone without considering a PM carve-out. The reasons for the carve-out (small fraction of engine operation, high emissions) do not apply for this testing because it is for data collection only. We included language which clarifies the speed tolerances and time periods for sampling and requires good engineering practice to be used to ensure that the sample time is properly aligned with the engine operation. We believe that it is appropriate to refer to sections 86.1340 and 86.1342 in when describing calculation formulas and procedures to ensure consistent procedures throughout Subpart N.

ISSUE 10: LOAD RESPONSE TEST

COMMENT A: General support for EPA's proposal to implement a load response test with a possible future action establishing appropriate emission standards for the test. **(American Lung Association (IV-D-19), STAPPA/ALAPCO (IV-D-32), Massachusetts Department of Environmental Protection (IV-D-12))**

RESPONSE: As we have noted in the proposed rule, the Load Response Test represents operation not adequately represented by the current FTP, and could eventually be used to ensure effective control of NOx and PM during this type of operation. The proposed rule also notes that the Consent Decrees with most of the heavy-duty diesel engine manufacturers establish target limits for the Load Response Test of 1.3 times the FTP standard for NMHC+NOx and 1.7 times the FTP standard for PM. We believe that establishing a future Load Response Test with appropriate emission limits may be a valuable addition to EPA's compliance program, and when the process of evaluating the available data is complete we intend to evaluate the addition of specific Load Response Test emission limits to EPA's compliance program in a future proposal. The data submittal requirement we have finalized under our authority in section 208 of the Clean Air Act will enable a better understanding of the emissions that occur under this type of operation and would ensure that EPA establishes robust standards in a future action.

COMMENT B: The Load Response Test does not represent normal operation for a truck engine. The data generated is not representative of on-road usage and is meaningless. The acceleration intended to be represented by the Load Response Test is adequately represented by the current Federal Test Procedure and other transient procedures, and the test is redundant. The test does not even test rapid accelerations, but would be run at constant speed. **((Engine Manufacturers Association (IV-D-05), Mack Truck, Inc. (IV-D-06), Detroit Diesel Corporation (IV-D-28), Navistar International (IV-D-29))**

RESPONSE: We disagree with the assertion that the Load Response Test does not represent an aspect of normal in-use operation. The Load Response Test is intended to address diesel engine emissions performance during sudden load changes from any engine rotational speed within the NTE zone. The test focuses on quantifying PM and NOx emissions during the portion of a truck's operation when a large load is suddenly applied to the engine. This type of load application is common during normal HD vehicle operation; such as the initial transition when a vehicle is attempting to accelerate from a dead stop, or during the initial transition period when a vehicle changes from a constant speed vehicle cruise to a vehicle acceleration mode in order to pass another vehicle, or during the initial transition period for a vehicle which is operating at a constant cruise speed which encounters a large increase in positive road grade (i.e., the transition from a flat road to an uphill grade). During these transition periods when a load is suddenly applied to the engine, we are concerned that certain engine emission controls can be inadequate, as described below.

In order to accelerate a vehicle, or to maintain vehicle speed during a steep change in positive road grade, a vehicle driver will commonly push the accelerator pedal to the maximum position. In response, a heavy-duty diesel engine's fueling system will increase the fueling rate quickly in order for the vehicle response to be adequate for the vehicle driver, and to accelerate the vehicle or to maintain vehicle speed during an increase in grade. In response, the fuel system can respond almost instantaneously, but the turbocharger will not; this is the well known turbocharger

lag issue, which can result in several seconds worth of low air-fuel ratio while the turbocharger rotational speed is increasing, during which the engine control system must restrict fuel in order to prevent excessive smoke and particulate matter.[22] However, this results in poor vehicle response, so engine manufactures are continually trying to improve the transient response of turbochargers and minimize turbocharger lag. With the introduction of EGR, the engine manufacturers may want to restrict or stop the flow of EGR during load application situations. Restricting or stopping EGR during the initial seconds of a load application will increase the air-fuel ratio and decrease turbocharger lag. Hence, there are two potentially negative environmental outcomes of a poor load acceptance engine control strategy: high PM and smoke from over-fueling and low air/fuel ratio, or high NOx emissions because the EGR flow has been restricted or stopped.

The load response test contained in this rule is intended to challenge the engine's control system during load acceptance situations, during which engine speed changes vary little during the initial seconds of a sudden load applied to the engine. See for example Chapter 12, "Transient Response of Turbocharged Engines" of "Turbocharging The Internal Combustion Engine."[23] This reference book on turbochargers discusses in detail the interaction of engine and turbocharger response during a load acceptance occurrence. For example, Figure 12.1 from this text book shows that during a load response test, fuel rack position went from minimum fuel to maximum fuel in less than 2 seconds, and engine load went from minimum to maximum in less than 2 seconds, engine rotational speed changed less than 300 rpm, and the turbocharger took more than 4 seconds to achieve a steady-state rotational speed at the higher load level. Figure 12.18 shows a similar result for an automotive diesel engine utilizing three different turbochargers, including a single stage turbocharger with aftercooler, which is typical of today's HDDE on-highway engine. Figure 12.18 shows that in response to a sudden load application, fueling is increased from a medium to maximum rate in less than 2 seconds, and engine rotational speed changes very little in the first few seconds (less than 200 rpm). The Load Response Test procedure promulgated in this final rule specifies that engine speed must be held constant when the fueling rate is suddenly set to the maximum rate, and we believe this is will provide us with emission test data that would indicate the robustness of the engine's transient load response calibrations with respect to it's emission performance.

We also disagree with the contention that such load application situations are completely and well-represented by current test procedures. The LRT provides data on the specific load acceptance situations described above, i.e., the short, transitional time period during which a load is suddenly applied to the engine. These situations may last for only a few seconds, and the LRT in this rule requires manufacturers to report emission data which is represented by these short time durations (the LRT procedures specify a total duty cycle of 10 seconds at each required test speed).

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[22] Turbocharger lag refers to the inability of the turbocharger to instantaneously respond to changes in engine speed and load because of its rotating inertia. See for example "Diesel Engine Reference Book", Chapter 23.14, Second Edition, 1999, published by SAE International, ISBN 0-7680-0403-9. Referenced section available for review in EPA Air Docket A-98-32, Docket Item IV-G-08.

[23] "Turbocharging of the Internal Combustion Engine", N. Watson & M.S. Janota, 1982, John Wiley & Sons, New York, ISBN 0-471-87072-2. Referenced section available for review in EPA Air Docket A-98-32, Docket Item IV-G-09.

The existing transient FTP is 1,200 seconds long, and thus does not provide emission data on the specific operation represented by the LRT.

The commenters are correct that the test is run at a constant engine speed. Consistent with the description above, the test is focused on how well the engine responds to the rapid application of a load, which may or may not be an acceleration event. As noted above, one good example of the type of operation that this test represents is the effort of a driver to maintain a given speed up a grade. In this case the load may rapidly change while the speed does not. Other examples of in-use operation that this test represents may ultimately result in a change in speed (e.g., starting a passing maneuver), but the focus of the test on the initial seconds of the application of the load to the engine will tend to minimize the speed change seen within the window of the test.

COMMENT C: The Load Response Test as proposed has no associated emission limits, therefore it has no environmental benefit and is not a cost-effective requirement. **(Mack Trucks, Inc. (IV-D-06), Detroit Diesel Corporation (IV-D-28), General Motors Corporation (IV-D-65))**

RESPONSE: Commenters are correct that the Load Response Test does not have associated emission limits in the proposed, or final, regulations. However, as noted above, we do believe that there is value to putting the test in place as a data collection requirement, and it will serve as an incentive for manufacturers to carefully evaluate emission performance over a specific type of operation not represented by current test procedures. We have appropriately accounted for the costs of running these tests (which, given the modifications made by the final rule, are relatively small) in the context of a very cost-effective emission control program.

COMMENT D: The Load Response Test test procedure is too vague to generate consistent or reproducible data. Many more parameters need to be specified in order for it to be a clear and fully specified engineering test procedure that produces comparable and repeatable results. **(Engine Manufacturers Association (IV-D-05), Mack Trucks, Inc. (IV-D-06), Detroit Diesel Corporation (IV-D-01, IV-D-28), Navistar International (IV-D-29))**

RESPONSE: We have finalized a Load Response Test that addresses these comments. A number of aspects of the test have been revised to add clarity and specificity based on stakeholder comments. See the comments and responses listed under Issue 9 in this document.

COMMENT E: EPA should remove the Load Response Test from the final rule. **(Mack Trucks, Inc. (IV-D-06), Engine Manufacturers Association (IV-D-05), Detroit Diesel Corporation (IV-D-28), General Motors Corporation (IV-D-65))**

RESPONSE: We have not removed the Load Response Test from the final rule. We believe that the test continues to have merit, as noted in the responses to the many issues raised regarding this test procedure.

COMMENT F: The ongoing certification data submittal requirement is burdensome and an unnecessary waste of resources. **(Engine Manufacturers Association (IV-D-05), Detroit Diesel Corporation (IV-D-28))** The data will be of no value to EPA. **(Engine Manufacturers Association (IV-D-05))**

RESPONSE: We have finalized certification data submission requirements which allow

manufacturers to carry across Load Response Test data from one model year to future model years for the same engine family. We have also finalized requirements which allow manufacturers to carry-across Load Response Test data from one engine family to other engine families which utilize similar emission control hardware. The use of these carry-over and carry-across provisions will provide the Agency with important information on new control technologies, while minimizing the testing and reporting requirements for the manufacturers. Thus, we believe that we have minimized the burden associated with this test in an appropriate way. The data does indeed have value to EPA. The data submittal requirement will enable a better understanding of the emissions that occur under this type of operation and would ensure that EPA establishes robust standards in a future action, if such standards are warranted. In addition, the data submittal requirement will ensure that manufacturers maintain an awareness of how their engines perform during this potentially high-polluting type of operation.

COMMENT G: EPA has not adequately demonstrated the technological feasibility of the smoke limits proposed for the Load Response Test. Using the NTE smoke limit for the Load Response Test is not appropriate. **(Engine Manufacturers Association (IV-D-05))**

RESPONSE: An incorrect cite to a specific regulatory section could have led readers to believe that we were applying the NTE smoke limits to the Load Response Test. This was the result of an error that is corrected in the final rule. We intended for the smoke limits at issue to refer to the NTE test procedures, not the Load Response Test test procedures. In fact, as noted in the NPRM and as continues to be the case in the final rule, there are no emission limits associated with the Load Response Test.

ISSUE 11: DIESEL FUEL QUALITY AND HD DIESEL STANDARDS

A number of the comments EPA received in response to the proposal regarding diesel fuel quality did not differentiate between the existing HDDE 2004 FTP standards which were finalized in 1997 and the proposed supplemental standards (NTE and SSS) which were proposed for 2004 but which are being promulgated for 2007. To the extent the comment discussed the 2004 FTP standard, those comments are responded to under Issue 7.3. In addition, where comments were written specifically regarding the supplemental standards those comments are addressed under Issue 8 (notably in response to Comment H, Issue 8.8). This section deals with comments which were not specifically directed towards either the existing 2004 FTP standard or the proposed supplemental requirements.

Comment A: Mack Truck Inc. (Mack) commented that EPA's failure to provide low sulfur fuel will result in a substantial increase in engine wear which therefore requires a reduction in engine useful life. Mack estimates this would increase the cost of diesel fuel less than 4 cents per gallon, and would also reduce particulate emissions from the entire diesel vehicle fleet.

The League of Women Voters commented that the discussion in the proposal of a phase two HDDE program which includes a reduction in diesel fuel sulfur should be included in the phase one program.

The State of Wisconsin Dept. of Transportation commented that EPA's decision not to require any diesel fuel changes at this time should only be made in light of supporting evidence that high sulfur levels in diesel fuel, or other properties, will not have an irreversible effect on the new and advanced emission control technologies (e.g., aftertreatment devices) to be used in meeting the standards.

The Engine Manufacturers Association commented that EPA's failure to provide low sulfur diesel fuel increases the stringency of the proposed standards. EMA's comments specifically discuss the use of cooled EGR, and concerns with engine durability from the formation of sulfuric acid in the recirculated exhaust gas.

The National Automobile Dealers Association (NADA) commented that low sulfur diesel fuel, with appropriate limits, will be necessary to enable or enhance the performance of exhaust gas recirculation based systems, as well as newer, sulfur sensitive aftertreatment technologies such as lean NOx catalysts and adsorbers, and PM filters. NADA commented that EPA must issue a final rule to establish low sulfur diesel fuel designed to make such fuel available in the marketplace concurrent with the first advanced diesel-powered vehicles.

The Wasatch Clean Air Coalition (WCAC) commented that EPA should require reductions in sulfur in diesel fuels. WCAC points to discussions in the NPRM that indicate diesel fuel sulfur does have an effect on PM emissions, and they point to a recent study by the Manufacturers of Emissions Control Association report that showed a 13 percent reduction in PM emissions from a 1998 U.S. on-highway certified HD diesel engine from the use of low sulfur fuel.

DaimlerChrysler (DC) commented that cleaner diesel fuel is required. DC recommended a 5ppm cap on diesel fuel sulfur, a lower T95 distillation end point, a cap on aromatics of 15 percent, a minimum cetane number of 55, and lower poly-nuclear aromatics. DC stated these changes are

necessary to realize the full emissions potential of clean diesel engine technology. DC also commented that lower diesel fuel sulfur levels are necessary for EGR to be successful in the field, because of the sulfates in the EGR which will corrode engine components and increase wear. DC comments that the best method to ensure that this problem will not occur is to reduce diesel fuel sulfur levels.

The Pennsylvania Department of Environmental Protection (P-DEP) urged EPA to reduce the levels of sulfur in diesel fuel. P-DEP commented that lowering the sulfur in diesel fuel would result in less fouling of aftertreatment devices such as diesel oxidation catalysts. In addition, P-DEP commented that raising the cetane number of diesel fuel from 43 to 50 can increase fuel efficiency and reduce NOX emissions by 5 to 10 percent, as well as reduce volatile organic compounds.

General Motors Corporation (GMC) commented the feasibility of EPA's proposed standards depends in part on further reductions in fuel sulfur. GMC comments that potential future reductions in HD engine standards are not feasible without major reductions in the sulfur content of diesel fuel and gasoline. GMC also points to their comments submitted as part of the Tier 2 rulemaking in which they make the case that reductions in fuel sulfur are necessary to meet the Tier 2 standards.

The International Center for Technology Assessment (ICTA) commented that advanced emissions-control systems require low-sulfur fuel, and failure to reduce fuel sulfur levels in diesel prior to the implementation of the proposed emission limits would render the standards ineffective. ICTA recommends EPA cap diesel fuel sulfur content at 10ppm in 2006, prior to the strict 2007 standards go into effect.

The Clean Air Network urges EPA to cut on-highway diesel fuel sulfur to a cap of 30ppm by 2004, and to a cap of less than 10 ppm by 2007 for three reasons. First, it is the only mechanism for curbing diesel exhaust from the existing fleet. Second, high sulfur exhibits or disables many promising emission control technologies. Finally, high sulfur in the fuel results in high emissions of PM (including PM-10, PM-2.5, and PM precursors), SO2 and other acid rain precursors from HDD vehicles. **(Engine Manufacturers Association (IV-D-05), Mack Trucks, Inc. (IV-D-06), League of Women Voters (IV-D-13), Wisconsin Department of Transportation (IV-D-17), National Automobile Dealers Association (IV-D-31), Wasatch Clean Air Coalition (IV-D-40), DaimlerChrysler (IV-D-44), International Center for Technology Assessment (IV-D-61), General Motors Corporation (IV-D-65), Clean Air Network (IV-D-34), Pennsylvania Department of Environmental Protection (IV-D-62))**

RESPONSE: We did not propose, and this final rule does not contain, any new requirements for diesel fuel quality. Based on available information at the time, we proposed that no change in diesel fuel quality is necessary for the HD2004 standards to be appropriate under the Clean Air Act. We have analyzed the comments received, and we have come to the same conclusion in this final rule. No change in on-highway diesel fuel quality is necessary for 2004. In the 1997 final rule which established the 2004 NMHC+NOx standard for HD diesel engines, we stated

> "*EPA is also finalizing today a regulatory provision providing for 1999 review of the standard levels finalized in this rule. As proposed, this review will reassess the appropriateness of the standards under the Clean Air Act including the need for and technical and economical feasibility of the standards based on information available in 1999.*" (62 FR 54699) and;
>
> "*As part of the 1999 review, EPA will evaluate in light of any new information whether diesel*

fuel improvements are needed for the standards to be appropriate for 2004." (62 FR 54700)

Changes in diesel fuel quality are not needed to meet the 2004 HDDE standards, nor the 2007 HDDE standards. See also the response to comments under issue 7 regarding our assessment that the 2004 FTP standards continue to be appropriate.

Regarding the comments from EMA that the failure to provide low sulfur fuel "increases the stringency" of the proposed standards, see the response to comment C under issue 8.3. As discussed there, the standards we have promulgated in this final rule are consistent with the requirements of the Clean Air Act.

Regarding the comments on engine durability concerns from the use of EGR, please see the response to comments under issue 7.3 (with respect to the 2004 FTP standard) and the response to comments sub-section titled "*Compliance Problems with NTE Due to Condensation and Corrosion Issues*" under issue 8.8 with respect to the NTE). As discussed in these sections and Chapter 3 of the RIA, manufacturers can utilize cooled EGR systems which are made with corrosive resistant materials and manufactured with high quality bonding processes in order to build durable EGR systems. These sections also discuss how manufacturers will control the EGR cooler temperature to operate at temperatures which will minimize the condensation of water vapor which can lead to sulfuric acid formation from the sulfur in the exhaust (which comes primarily from the sulfur in the fuel). Finally, the discussion under issue 8.8 describes a provision in the final rule which will eliminate EGR sulfur corrosion issues under cold operating conditions during NTE operation which could lead to engine wear concerns. The design and manufacturer of corrosive resistant EGR systems, combined with appropriate EGR cooling targets and the provisions in this rule which exempt the engine from complying with the NTE during the cold temperature operating conditions which would lead to corrosion, will enable engine manufacturers to design engines with EGR systems which will comply with the 2004 and 2007 standards for the full useful life of the engines, using currently available on-highway diesel fuel.

Regarding the comment from General Motors, EPA answered the Tier 2 related comments in the Tier 2 final rulemaking. General Motors provides no evidence that the heavy-duty gasoline standards are infeasible, especially given the availability of low-sulfur gasoline; nor does General Motors provide any comments regarding the effect of diesel fuel on the feasibility of the HD diesel standards finalized in this rule.

Regarding the comment from the State of Wisconsin Dept. of Transportation, we have responded to the issues raised by the manufactures regarding the application of cooled EGR and the potential for in-use durability concerns in this final rule, and no change in the useful life for heavy-heavy duty diesel engines has been made. See the response to comments under issue 7 and 8.

In response to the comments from NADA, EPA agrees that lower diesel fuel sulfur levels are likely necessary to enable certain diesel aftertreatment devices, such as NOx adsorber catalysts. As discussed in our proposal and elsewhere in this final rule, the use of sulfur intolerant aftertreatment devices are not needed to achieve the standards contained in today's FRM for HD diesel engines. The standards contained in today's final rule can be achieved through the combined use of cooled EGR, advanced fuel injection systems, advanced turbocharging systems, and electronic engine control. Lower sulfur diesel fuel is not needed for the standards in this rule to be

feasible for the useful life of the engines. NADA comments that low sulfur diesel fuel would enhance or enable the performance of EGR systems for HDDEs. We are aware of no data which indicates low sulfur fuel would enhance the NOx reducing capabilities of an EGR system on a HDDE, and the commenter provided no such data. With regards to the durability concerns regarding EGR systems and diesel fuel sulfur levels, see above.

DaimlerChrysler provided no data to support their recommendation for non-sulfur related changes to diesel fuel quality, specifically, their recommendation for; a lower T95 distillation end point, a cap on aromatics of 15 percent, a minimum cetane number of 55, and lower poly-nuclear aromatics (PNAs). Therefore, it is difficult to evaluate the merits of their recommendation. The Pennsylvania Department of Environmental Protection also commented that increasing the cetane number in diesel fuel can lower NOx emissions. The RIA for the proposal (Docket A-98-32, Docket Item III-B-01), and the RIA for this final rule contained a discussion of the emission impacts from changes in diesel fuel property on 2004 technology engines (e.g., engines equipped with EGR). This work indicated a change in cetane number from 42 to 52 did not have a statistically significant impact on HC+NOx emissions, and a monoaromatics from 25 to 10 percent lowered HC+NOx by less than 5 percent, and a change in polyaromatics from 10 to 2.5 percent lowered HC+NOx emissions by less than 3 percent. We are not aware of any data on the effect of lowering diesel fuel PNA content on HC+NOx emissions from a 2004 or 2007 technology engines. Changes in diesel fuel quality for 2004 on-highway engines are not needed to make the standards contained in this final rule technologically feasible, and available data indicates that little if any emission reduction from 2004 technology engines would occur from changing a number of diesel fuel quality parameters.

The comments from the International Center for Technology Assessment appear to confuse our proposal's discussion of the potential for future HDDE standards in the 2007 time frame using advanced aftertreatment which may require low sulfur diesel fuel with an actual proposal for future standards. The League of Women Voters provide no reasons for reducing sulfur content of diesel fuel in this rule. We did not propose and this rule does not contain new aftertreatment based standards which rely on low diesel fuel sulfur levels. However, the Agency has recently released an NPRM for new HDDE standards in the 2007 time frame which proposed very low PM and NOx standards based on the use of aftertreatment, and this proposal includes significant reductions in on-highway diesel fuel sulfur levels in order to enable the use of advanced diesel aftertreatment devices for the HD industry. (See 65 FR 35429, June 2, 2000). See also the discussion under Issue 28.

We disagree with the comments from the Pennsylvania Department of Environmental Protection regarding current diesel fuel sulfur levels and the fouling of diesel oxidation catalysts (DOC). Data we have examined on the in-use durability of DOCs indicates these catalysts are durable in-use at current diesel fuel sulfur levels. [24] It is possible that other types of DOCs could be enabled by lower diesel fuel sulfur levels, but such a reduction in fuel sulfur levels are not necessary to meet the standards contained in today's rule.

The comments from the Wasatch Clean Air Coalition (WCAC) suggest that diesel fuel sulfur

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[24] Memo to EPA Air Docket A-98-32 from William Charmley dated October 12, 1999. A-98-32, II-B-06.

reductions would enable lower PM standards to be achieved by HDDEs. Please see the discussion in response to Comment D under Issue 7.2, where we discuss that diesel oxidation catalysts result in only modest reductions in PM emissions from some HDDEs. WCAC provides no information regarding the appropriateness of reducing diesel fuel sulfur levels, including the cost of such reductions, given the modest emission benefit of such a reduction. We did not propose to change the PM standard or diesel fuel sulfur levels in this rule, and no change is included in this final rule. The comments from the Clean Air Network suggest that reducing sulfur levels could curb diesel exhaust from existing trucks and buses. Clean Air Network provides no information regarding the extent to which such emissions can be reduced and the cost-effectiveness of such emissions. As discussed above, the Agency recently published an NPRM which considers a number of the issues raised by the commenters. (See 65 FR 35429, June 2, 2000). See also the discussion under Issue 28.

Comment B: Sunoco support's EPA's conclusion that diesel fuel changes are not needed for the proposed 2004 HD engine standards. Sunoco stated that they believe all data shows that further emission reductions can be achieved with engine design modifications. Sunoco states that the recent SwRI prototype engine fuel test program showed minor impacts that diesel fuel cetane, gravity, and aromatic content. Sunoco also submitted comments that EPA should consider the refinery as a system, that there are several overlapping fuel regulations which could lead to several problems, and various other comments related to future fuel issues.

The American Trucking Association supports EPA's conclusion that no change in diesel fuel is necessary for meet the 2004 standards. ATA also rejects any request by the engine manufacturers that seeks to trade off durability improvements without changes in diesel fuel specifications.

The American Petroleum Institute concurs with EPA's conclusion that no change in diesel fuel quality is necessary to achieve the 2004 HD diesel standards. To support their assertion, API points to a recent Manufacturers of Emission Controls Association report entitled "Demonstration of Advanced Emission Control Technologies Enabling Diesel-Powered Heavy Duty Diesel Engines to Achieve Low Emission Levels", which API states demonstrated advanced exhaust emission control technology can be used in conjunction with commercially available Number 2 diesel to achieve low levels of PM and NMHC+NOx.

The National Petrochemical and Refiners Association (NPRA) states that the standards in this rule can be met with existing on-highway diesel fuel and no change in diesel fuel properties is necessary. NPRA also stated that consideration of fuel sulfur controls must include evaluations of technical feasibility, environmental need, and cost effectiveness.

NESCAUM concurs with EPA's conclusion that no change in diesel fuel is needed in order for manufacturers to comply with the 2004 standards for NMHC+NOx. NESCAUM comments that the sulfur corrosion from the use of cooled EGR can be overcome with the introduction of corrosive resistant materials such as stainless steel. Because the 2.4 g/bhp-hr NOx standard can be met without the use of NOx adsorbers, there is no need to change diesel fuel. In addition, NESCAUM supports the introduction of low sulfur fuel to enable aftertreatment devices which can substantially lower NOx and PM emissions from HDDEs, and lower sulfate emissions from existing HD engines. **(Sunoco (IV-D-11), Massachusetts Department of Environmental Protection (IV-D-12), American Trucking Association (IV-D-21), American Petroleum Institute (IV-D-23), Northeast**

States for Coordinated Air Use Management (IV-D-26), National Petrochemical and Refiners Association (IV-D-42))

RESPONSE: We agree with the comments supporting our conclusion that no change in diesel fuel sulfur is necessary to meet the standards contained in today's rule.

Regarding Sunoco and NPRA's comments on future and existing fuel requirements - in this rulemaking EPA did not propose and has not finalized any regulatory requirements on the fuel industry, therefore these comments are not relevant to this final rule.

Regarding NESCAUM's comments on lowering diesel fuel sulfur to enable certain aftertreatment devices in order to lower the emissions of NOx and PM from HDDEs. We did not propose lower standards based on advanced aftertreatment, and none are contained in this rule. However, the Agency has recently released an NPRM for new HDDE standards in the 2007 time frame which proposed very low PM and NOx standards based on the use of aftertreatment, and this proposal includes significant reductions in on-highway diesel fuel sulfur levels in order to enable the use of advanced diesel aftertreatment devices for the HD industry. (See 65 FR 35429, June 2, 2000). See also the discussion under Issue 28.

ISSUE 12: AVERAGING, BANKING, AND TRADING PROGRAM FOR HEAVY-DUTY DIESEL ENGINES

COMMENT A: NESCAUM expressed general concern with the HD ABT program because of the perceived lack of a viable in-use enforcement program, and the ability of manufacturers to set family emission limits (FEL) that are inappropriately low because they do not properly consider in-use deterioration because of the lack of a credible enforcement program. NESCAUM suggests this issue can be resolved with a commitment by EPA to routinely test and enforce emission standards in-use. **(Northeast States for Coordinated Air Use Management (IV-D-26))**

RESPONSE: We disagree with the inference from NESCAUM that the Agency does not enforce existing emission standards. The Agency has always enforced its stanards, and will continue to enforce the emission standards promulgated. The Agency does believe an in-use testing program will help ensure engine manufacturers appropriately establish FELs for the full useful life of HDDEs. As discussed under Issue 27, we intended to work with engine manufacturers and other interested parties to establish an appropriate in-use compliance program for the HD industry. The Agency has in the past and will continue to test HD engines and vehicles in-use as deemed appropriate.

COMMENT B:. The New York State Department of Environmental Conservation commented that they oppose the continuance of the ABT program as currently proposed. They specifically express concern that the opportunity exists for manufacturers to generate credits by manufacturing very clean light-heavy duty diesel engines, and use these credits to manufacturer higher emitting line-haul truck applications. **(New York State Department of Environmental Conservation (IV-D-41))**

RESPONSE: Our proposal did not contain any suggested changes to the ABT program for heavy-duty diesel engines for 2004, which was finalized in 1997, and this final rule does not modify in anyway the HD diesel ABT program for 2004. The 1997 rulemaking for HD diesel engines created a new ABT program structure for the 2004 standards. However, the 1997 rule maintained the long standing ABT program requirement which prohibits engines from different service classes from exchanging emission credits (See 40 CFR 86.004-15(d) and (e)). This regulatory provision prohibits the averaging or trading of NMHC+NOx credits between light-heavy, medium-heavy, and heavy-heavy duty diesel engines, and PM credits cannot be averaged or traded between any of the above service classes, as well as urban buses as a separate service class. Therefore, the situation the commenter is concerned with is already prohibited from occurring.

ISSUE 13: DIESEL CRANKCASE EMISSIONS

COMMENT A: The New York State Department of Environmental Conservation commented that EPA should establish standards or requirements which would eliminate the crankcase emissions from HD diesel engines, based on the potential for high benzene emissions from this source. **(New York State Department of Environmental Conservation (IV-D-41))**

RESPONSE: We did not propose, and this final rule does not contain, any requirements on the crankcase emissions from on-highway heavy-duty diesel engines. EPA has long been concerned with the uncontrolled crankcase emissions from heavy-duty diesel engines. The most economical means of controlling these emissions is to re-route the crankcase emissions back into the intake system. Unfortunately this can have durability impacts on the intake system (turbocharger and intercooler), as well as the cylinder kit. EPA has recently become aware of a number of promising technologies to address the potential negative impacts on engine durability which can arise from closing diesel crankcases. A number of these technologies rely on the need for low sulfur diesel fuel. We have recently proposed to require closed crankcases for on-highway HDDEs. (See 65 FR 35429 & 35463, June 2, 2000) However, this issue was not raised in our proposal, and therefore we cannot take action on it in this final rule.

ISSUE 14: STANDARDS FOR OTTO-CYCLE COMPLETE VEHICLES

COMMENT A: We received comment supporting the proposed standards for heavy-duty vehicles. Commenters stated that these revised standards are necessary for air quality and that they will result in harmonization across all 50 states. California certification data was referred to as supporting the feasibility of these standards. Commenters stated that it is important that we tighten up standards for Otto-cycle compete vehicles so that we don't allow a loophole for SUVs. MECA stated that high-efficiency three-way catalysts can be used to meet the proposed standards and that their thermal durability has improved greatly in the past five years. **(Massachusetts Department of Environmental Protection (IV-D-12), Sierra Club (IV-D-15), American Lung Association (IV-D-19), Northeast States for Coordinated Air Use Management (IV-D-26), STAPPA/ALAPCO (IV-D-32), Manufacturers of Emission Controls Association (IV-D-38), Clean Air Coalition (IV-D-40), Environmental and Energy Study Institute (IV-D-77))**

RESPONSE: We agree with these comments and consider them to be consistent with our proposal and final rule.

COMMENT B: Engelhard submitted comments on their PremAir catalyst technology. These comments apply to the proposal for Otto-cycle vehicle standards, as well as diesel and Otto-cycle engine standards, as and are summarized earlier in Section 7.4, Comment H. **(Engelhard Corporation (IV-D-9))**

RESPONSE: See Section 7.4, Comment H.

ISSUE 15: OTTO-CYCLE ENGINE STANDARDS

Issue 15.1 Level of the Standards

COMMENT A: Several engine manufacturers commented that the proposed standards for HDGEs are too stringent. Two engine manufacturers recommended a level of 1.5 g/bhp-hr NMHC+NOx, while two recommended a level of 2.0 g/bhp-hr. One manufacturer commented that a 2.0 g/bhp-hr NOx standard would still gain 70% of the reductions presented in the RIA.

These manufacturers challenged our argument that 1.0 g/bhp-hr is feasible because many engines are already certifying below this level. They stated that these engines are certified using deterioration rates for an average vehicle. However, they need a compliance margin of 50 to 75% below the standard to account for the 10% of the vehicles which suffer the worst deterioration. The manufacturers noted that they maintain this cushion between the standard and their certification level in part due to the potential for in-use deterioration of catalysts and oxygen sensors beyond that captured during the certification process. Catalysts experience wide variations in exhaust temperature due to the wide and varied usage of vehicles in the field. Some vehicles may experience more severe in-use operation than is represented by the durability testing conducted for engine certification. The manufacturers have argued that we should not set new standards based on certification data because certification levels do not account for severe in-use deterioration.

One manufacturer commented that HDGVs greater that 14,000 lbs. GVWR would be likely to exceed the proposed standards today and that it would require extensive calibration and aftertreatment development to meet the proposed standards. Commenters stated that these engines have longer, harsher lives than lighter applications and would see more deterioration.

Prior to the NPRM, manufacturers discussed the need for compliance cushion and presented an analysis of the Otto-cycle engine emissions standards for 2004 (Docket A-95-27, IV-E-26 and IV-E-27). The analysis assumed:

- NOx catalyst efficiency of 90.9 percent at the end of the engine's useful life;
- An engine-out NOx level of 12 g/bhp-hr;
- A cushion of 0.3 g/bhp-hr for engine variability and a safety margin of 20 percent of the standard;
- Tailpipe NMHC levels of 15 percent of the NOx level (0.26 g/bhp-hr).

Based on these assumptions, manufacturers recommended a 2.0 g/bhp-hr NMHC plus NOx standard.[25] Manufacturers noted that a catalyst efficiency of about 97 percent would be needed to meet a 1.0 g/bhp-hr standard and that their assessments of post-2000 catalysts indicate worst case performance well below this level. The manufacturers' recommended 2.0 g/bhp-hr standard indicated that compliance cushions greater than half the standard are needed.

In the NPRM, we stated that we believe this analysis to be overly conservative. We argued that engine out emissions could be further reduced and that the analysis underestimated the

[25] 12.0 g engine out x.091 for catalyst efficiency + 0.65 for compliance cushion = 1.74 g NOx. The difference between 2.0g and 1.74 g is reserved for NMHC emissions.)

efficiency and durability of modern catalysts. We also questioned the need for an additional safety margin and engine variability cushion if only the worst case scenario is considered.

In response to our analysis, the manufacturers stated that they would need a 96-97% conversion efficiency at the end of useful life to meet the proposed standards and that this level of efficiency has never been proven. This need stems from their inability to reduce engine out NOx levels below 12 g/bhp-hr and still maintain the integrity of their products. The manufacturers commented that reducing NOx through timing retard would increase exhaust temperatures, which would hurt catalyst durability. They also stated that timing retard hurts fuel efficiency and power. They stated that exhaust gas recirculation would not be effective for HDGEs because the majority of operation over the HD FTP is at high speeds and loads where EGR cannot be used effectively. Also they commented that past practices have shown that they need to design for a 20% margin of safety plus an additional 0.3 g/bhp-hr for NOx variability. **(Engine Manufacturers Association (IV-D-05), Ford (IV-D-08), Daimler Chrysler (IV-D-44), General Motors/Isuzu (IV-D-65))**

RESPONSE: We disagree with the manufacturers analysis of heavy-duty gasoline engine emission performance in the 2004-5 time frame. The final rule establishes a 1.0 g/bhp-hr MNHC+NOx standard beginning in model year 2005. Manufacturers noted on several occasions that they target emissions certification levels of about half the standard. Taking manufacturer's claimed practices into account, we would expect that engines certified in the 0.5 g/bhp-hr NOx plus NMHC range would meet a 1.0 g/bhp-hr standard.

Catalyst system durability is a key issue in the feasibility of the standards. Historically, catalysts have deteriorated when exposed to very high temperatures and this has long been a concern for heavy-duty work vehicles.[26] Manufacturers have often taken steps to protect catalysts by ensuring exhaust temperatures remain in an acceptable range. For example, HD gasoline engine manufacturers typically use engine enrichment strategies under high power modes to decrease exhaust gas temperatures and for catalyst protection, this type of strategy was discussed in the comments from General Motors to this rulemaking (See Section IV.B.5 of the comments from GM, Docket Item IV-D-66).

Catalyst technologies in use currently are much improved over the catalysts used only a few years ago. The improvements have come with the use of palladium, which has superior thermal stability, and through much improved washcoat technology. The use of rhodium with palladium will also enhance performance of the catalyst. The catalysts have been shown to withstand temperatures typically experienced in HD applications.[27] Manufacturers also continue to limit

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[26] See for example "Overview of Recent Emission Control Technology Developments - Emission Control of Gasoline-Powered Heavy-duty Engines", Manufacturers of Emission Controls Association, November 18, 1997. Copy Available in EPA Air Docket A-98-32

[27] For a discussion of the improvements made in recent years (including higher temperature operating regions of today's catalysts and improvements in washcoats), as well as the increased use of palladium and rhodium in both light-duty and HD gasoline catalysts systems see "Overview of Recent Emission Control Technology Developments - Emission Control of Gasoline-Powered Heavy-duty Engines", Manufacturers of Emission Controls Association, November 18, 1997. Copy Available in EPA Air Docket A-98-32, Docket Item IV-G-11.

exhaust temperature extremes not only to protect catalyst systems but also to protect the engine. Our final rule requirements make no changes in the manufacturers long-standing ability to take the necessary steps to protect engine and emission control systems from high temperatures. For example, as a requirement of the certification requirements HD gasoline manufacturers have typically described auxiliary emission control devices (AECDs) which protect the engine and/or catalysts from damage due to high temperatures, we have made no changes in this final rule which would prevent engine manufactures from getting approval for legitimate AECDs.

The manufacturers stated that their catalyst assumptions represented catalyst deterioration based on worst case vehicle operation (highly loaded operation, high exhaust temperatures). Details of the catalyst were not available except that manufacturers stated that the catalyst represented post-2000 catalyst technology. Due to the lack of detail, it is difficult to evaluate the assumption. However, given the recent developments in catalyst technology, the four-years of lead time available, and methods available to protect catalysts under worst case vehicle operation discussed previously we did not change our HDGE standard based on the manufacturers catalyst data discussed in their comments.

Engine-out NOx levels are also critical to the analysis. In their analysis, manufacturers assumed engine-out NOx levels of 12 g/bhp-hr, based on manufacturer development data for one engine. Other available data on recent model year heavy-duty gasoline engines indicate that several engines have engine-out NOx emissions well below this level in the 6 to10 g/bhp-hr range, therefore we did not base our analysis on the engine-out NOx level of 12 g/bhp-hr suggested by the commenters.[28] We do not believe that the current standards have encouraged manufacturers to place a high priority on engine-out emissions levels. For recent model year engines, catalysts have provided the majority of needed emissions control.

We believe the proposed standards will require manufacturers to focus some effort on engine-out emissions control and that engine-out NOx levels in the 6 to 8 g/bhp-hr are reasonably achievable. For engines not already in the 6 - 8 g/bhp-hr, some re-calibration of engine systems including the EGR system and perhaps some modest hardware changes to those systems would be necessary. See for example two recent Society of Automotive Engineers papers which look at the effect of EGR on modern gasoline engine out NOx emissions, and which indicated modest changes in EGR calibration strategies can produce NOx reductions on the order of 50 percent, which would allow the manufacturers suggested 12 g/bhp-hr engine out NOx level to be reduced to a level between 6 and 8 g/bhp-hr.[29] We do not believe that these modest changes will have a significant effect on fuel economy or engine drive characteristics, especially given the flexibility that engine manufacturers have to optimize their engine through electronic control. In fact, SAE 2000-01-1957

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[28] These data were supplied by a HDGE manufacturer and are considered Confidential Business Information.

[29] See SAE paper 2000-01-1957, “Demonstration of Tier 2 Emission Levels for Heavy Light-duty Trucks” which discussed the use of EGR on a Ford 5.4 gasoline engine. This engine is also certified as a HD gasoline engine, a copy of this paper is available in EPA Air Docket A-98-32, Docket Item IV-G-10. For additional discussion of the use of EGR on gasoline engine performance see SAE paper 1999-01-0774, “Using Advanced Emission Control Systems to Demonstrate LEV II ULEV on Light-duty Gasoline Vehicles”.

indicates small improvements in fuel economy may be realized with increased use of EGR due to the decrease in pumping losses in the engine from increased throttle openings to meet the same power requirements without EGR. We do not anticipate large exhaust temperature increases from these modest calibrations; in addition, today's catalysts are capable of operating at temperatures as high as 1100°C.[30] EGR plays a key role in reducing engine-out NOx and system redesign may allow more effective use of this technology. Manufacturers commented that EGR is not effective on the FTP because it is primarily made up of high speed and load operation. However, the HD- FTP is actually primarily light operation; it has an average power factor of about 20 percent, and 28 percent of the time is spent at idle conditions.

We also considered the engine variability factor of 0.3 g/bhp-hr built into the manufacturers analysis. The analysis as presented assumed a 12 g/bhp-hr engine-out NOx level. Manufacturer data for the developmental engine suggested that 12 g/bhp-hr is the worst case engine-out level anticipated (the actual highest test point recorded was 12.65). It appears to us that manufacturers double counted engine variability by using the worst case engine data and an engine variability factor. Using engine-out NOx levels of 12 g in the analysis but without the engine variability factor yields a NOx + NMHC level of 1.6 g/bhp-hr. Without including a safety margin, which may be appropriate considering the analysis is already based on worst case engine and catalyst assumptions, the level would be 1.3 g/bhp-hr. To reach the 1.0 g/bhp-hr level with this engine and a 20 percent safety margin, a catalyst efficiency of 94 percent would be needed. The catalyst efficiency would need to be 93 percent if the 20 percent safety margin were not included in the analysis.

When coupled with a catalyst with worst case efficiencies in the 91 to 93 percent range, these engines could achieve the proposed standards. Of course with higher catalyst efficiencies, manufacturers would not have to achieve lower NOx engine-out levels. Catalyst efficiencies of about 93 percent would allow manufacturers to maintain compliance margins in the range of 25 and 45 percent of the standard. We believe these margins are sufficient considering the analysis is also based on worst case catalyst efficiencies. Under better conditions, we would expect lower emissions, therefore all model year 2005 HDGE's should be capable of achieving a 1.0g/bhp-hr NMHC+NOx standard.

COMMENT B: Several commenters stated that they strongly support the proposed 1.0 g/bhp-hr NMHC+NOx standard for HDGVs. These commenters gave several reasons that they consider the proposed standards to be technically feasible. They pointed out the certification levels in California that are below the proposed standard. In addition, they commented that light-duty vehicle technology is easily transferrable to heavy-duty gasoline engines. Examples of technology included in these comments which could be used to meet the proposed standards are exhaust gas recirculation, leak free exhaust, improved 3-way catalysts, and closed loop control of the air/fuel ratio. **(Massachusetts Department of Environmental Protection (IV-D-12), Northeast States for Coordinated Air Use Management (IV-D-26), Manufacturers of Emission Controls Association (IV-D-38), Coalition for Clean Air (IV-D-53))**

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[30] See "Overview of Recent Emission Control Technology Developments", Manufacturers of Emission Controls Association, November 18, 1997. Copy Available in EPA Air Docket A-98-32, Docket Item IV-G-11.

RESPONSE: We agree with these comments and consider them to be consistent with our proposal and final rule.

Issue 15.2 Voluntary Standards

COMMENT C: We discussed two options for voluntary standards with Ford, General Motors, and Daimler-Chrysler over a series of meetings. Summaries of these meetings may be found in the docket. Manufacturers commented favorably on the optional standards shown in the Table below:

	Option A	Option B
Effective date of standards (entire product line)	2003	2004
Engine standard	1.5 g/kW-hr NMHC+NOx	
Chassis standard	California MDV LEV I	California MDV LEV I
Certification testing for complete vehicles	Engine based testing allowed through 2006 for all heavy-duty gasoline vehicles Chassis based testing 2007+	Chassis based testing
OBD II	Phase-in for >14,000 lbs. GVWR HDGVs of 40/60/80/100% in 2004-2007	
ORVR	Phase-in for complete HDGVs <10,000 lbs. GVWR of 40/80/100% in 2004-2006	
ABT	Cross-trading between engine and chassis certifications through 2007	

(General Motors (IV-D-147), comments received from Ford Motor Company, and comments received from DaimlerChrysler Corporation)

RESPONSE: We believe that the voluntary programs will provide compliance flexibility to the manufacturers without a negative impact on emissions. The early introduction of these voluntary 2003 and 2004 standards offset the temporary relaxation in the standard. Therefore we are finalizing these voluntary options.

Issue 15.3 Fuel Sulfur Level

COMMENT D: One engine manufacturer recommended that we require a fuel sulfur level maximum of 5 ppm for both emission testing and for in-use operation. They commented that sulfur is a poison to the emission control system and could have adverse effects on an onboard diagnostic monitoring system. **(Daimler Chrysler (IV-D-44))**

RESPONSE: We recognize that high levels of sulfur in fuel can have adverse impacts on emissions control for HDGVs, especially due to catalyst poisoning. However, we do not believe that

5 ppm sulfur fuel is necessary for this level of standards. Engines that have already certified to levels below the new standard have done so using certification fuels with 40-50 ppm sulfur. In addition, the manufacturers had to design for in-use fuels with average sulfur levels near 300 ppm. Further, as a result of the recent Tier 2 standards for light-duty vehicles, refiners will be required to meet an average sulfur level of 30 ppm for their on-highway gasoline. This requirement will be phased in from 2004 to 2006.

Issue 15.4 Alternative Fueled Engines

COMMENT E: Detroit Diesel commented that natural gas and methanol engines derived from diesel engines should be held to the diesel engine standards and not the Otto-cycle engine standards. **(Detroit Diesel (IV-D-08))**

RESPONSE: We agree and have modified our regulatory language to make this clear.

Issue 15.5 Other Potential Benefits

COMMENT F: Engelhard submitted comments on their PremAir catalyst technology. These comments apply to both diesel and Otto-cycle engine standards and are summarized earlier in Section 7.4, Comment H. **(Engelhard Corporation (IV-D-09))**

RESPONSE: See Section 7.4, Comment H.

Issue 15.6 Combining Engine Families Above and Below 14,000 Pounds GVWR

COMMENT G: One commenter recommended that we allow engines intended for vehicles over 14,000 lb. GVWR to be certified according to the 14,000 lb. and under GVWR provisions in order to allow flexibility to group engine families together and reduce costs. **(Ford (IV-D-08))**

RESPONSE: The flexibility to allow engines intended for vehicles over 14,000 lb. GVWR to certify along with engines intended for incomplete vehicles with a GVWR of 14,000 lb. or under currently exists in our regulations. The standards are set up in two categories to apply either to engines intended for vehicles over 14,000 lb. GVWR, or to engines intended for all vehicles (not just vehicles at or below 14,000 lb. GVWR). A manufacturer may certify any engine family to the standards applicable to engines intended for all heavy-duty vehicles. A manufacturer may also group engine families together for such purposes, consistent with the current requirements for engine family definition. Thus, we believe that the flexibility that the commenter requested currently exists in the regulations and there is no need to make specific changes to allow it. It should be noted that this provision only applies to engines, and not complete vehicles. Complete vehicles under 14,000 lbs. GVWR must comply with the chassis-based standards and CAP 2000 compliance program.

ISSUE 16: EVAPORATIVE EMISSIONS AND ONBOARD REFUELING AND VAPOR RECOVERY FOR OTTO-CYCLE ENGINES

COMMENT A: One commenter expressed support for the chassis-based evaporative emission test procedures for complete vehicles (NESCAUM). One stated that we should allow the use of the light-duty driving cycle for all heavy-duty evaporative testing, not just for complete vehicles as proposed (EMA). This commenter argued that the commercial nature of heavy-duty vehicles affords them more purge time than light-duty vehicles and trucks. Two commenters stated that more stringent evaporative emission standards are feasible at little or no cost, citing current evaporative certification levels (ALA, STAPPA/ALAPCO). They also pointed out that current certification safety margins appear to be going away. These commenters said that CARB's new evaporative emission standards would be appropriate as federal standards. One commenter argued that any future evaporative emission standards will require careful consideration and cooperation with the manufacturers (EMA). **(EMA (IV-D-05), ALA (IV-D-19), NESCAUM (IV-D-26), STAPPA/ALAPCO (IV-D-32))**

RESPONSE: We agree that the use of the light-duty driving procedure for both chassis and engine evaporative certification testing is both consistent and appropriate. Thus, we are allowing the use of the light-duty test procedure for evaporative testing for both complete heavy-duty vehicles and heavy-duty engines. We did not propose more stringent evaporative standards and are therefore not finalizing any as part of this action. However, we are considering more stringent heavy-duty evaporative standards in an upcoming rulemaking action.

COMMENT B: One commenter supported our proposed ORVR requirements with no suggested changes (NESCAUM). Two commenters supported ORVR as proposed for those vehicles which have light-duty counterparts, but suggested a delay until the 2006 model year for vehicles which do not have light-duty counterparts or which have fuel tank capacity greater than 35 gallons (EMA, Ford). One commenter stated that allowing a delay until 2006 for vehicles which do not have light-duty counterparts or whose fuel tanks are greater than 35 gallons would result in a competitive disadvantage for those vehicles which have to comply with ORVR requirements prior to he 2006 model year (DaimlerChrysler). This commenter suggested that ORVR for all complete heavy-duty vehicles up to and including 10,000 lb. GVWR should start with the 2006 model year.

RESPONSE: Our proposal to include heavy-duty vehicles in the same ORVR phase-in schedule with heavy light-duty trucks was based on the assumption that many complete HDVs have fuel systems that are essentially the same as their light-duty counterparts. We received no comments disagreeing with this assumption. For these HDVs with light-duty counterparts, the ORVR development work already being done to comply with the LDT requirements can be readily applied to the HDV configurations. However, the development work must be done specifically for HDVs that do not have light-duty counterparts, as well as those with larger fuel tanks. Thus, we believe it is appropriate to allow additional lead time for this development work to occur for these vehicles. Thus, for HDVs which do not share an identical fuel system with a heavy LDT, as well as for HDVs which have fuel tanks greater than 35 gallons, compliance with the ORVR standards will be required with the 2006 model year. We do not believe that this delay for these vehicles gives them a competitive advantage. We also believe that the cost of ORVR systems (less than $10 per vehicle) is simply too small to have any real competitive impact when considered in the context of the total vehicle cost.

ISSUE 17: AVERAGING, BANKING AND TRADING (ABT) FOR OTTO-CYCLE ENGINES AND VEHICLES

COMMENT A: EPA received comments both in support of and against allowing the trading of ABT credits between engine-certified and chassis-certified vehicles. Several manufacturers commented that EPA should allow trading of credits between chassis-certified vehicles and vehicle equipped with engines certified to engine-based standards. In response to our request for comment on the methodology for such a trading provision, one commenter (EMA) recommended that EPA allow individual manufacturers to submit proposals for the conversion of credits, subject to the Administrator's approval. The plans would be submitted prior to the model year and EPA would assess the plans on a case-by-case basis. Another commenter (GM) recommended that EPA establish an exchange rate for credit conversions. The manufacturers noted that allowing credit exchanges is essential due to the low volumes of engine families and engine sales that will be subject to engine-based standards. One commenter (NESCAUM) urged EPA not to allow engine credits to be used in the vehicles program, noting that manufacturers will not need this flexibility to meet the chassis-based standards (which are equivalent to California LEV standards). **(Engine Manufacturers Association (IV-D-05), General Motors Corporation (IV-D-65), NESCAUM (IV-D-26))**

RESPONSE: We do not view the transfer of credits as necessary for manufacturers to be able to meet the standards we are finalizing, considering the level of the standards and the lead time available. For the vehicles standards, manufacturers will be meeting the standards prior to 2004 in California for the vast majority of their complete vehicle product line. There may be cases where manufacturers have a few products not available in California and they may want to use the ABT program for those products. We believe that the vehicle ABT program without credit exchanges offers sufficient flexibility for manufacturers.

For the engine standards also, we do not believe that credit exchanges are necessary to allow manufacturers to be able to meet the new standards. The engine-based ABT program provides opportunities to earn early engine-based credits, especially under Option 3 which begins with the 2005 model year, one year later than proposed. In addition, the adoption of two early implementation options containing a higher engine standard provides flexibility and diminishes the need for engine-based credits.

However, early implementation options 1 and 2 provide clear benefits compared to Option 3 and we believe it is appropriate to provide additional incentives to manufacturers to select one of these options. Therefore, we are allowing credit transfers between the vehicles and the engines programs as part of Option 1 and Option 2 for a limited time. This flexibility, in addition to the somewhat higher standard, may provide incentive for manufacturers to select one of these early implementation options. To the extent that manufacturers select Options 1 or 2, technology will be introduced earlier (2003 or 2004) than would otherwise occur (2005). As described in the preamble, the exchange of credits is constrained to credits earned during the years that manufacturers are meeting the 1.5 g/bhp-hr standard, through the 2007 model year, and transferred credits may not be banked for future use.

We concur with EMA's comments regarding the conversion of credits from the vehicles program to the engine program. We continue to believe that vehicle/engine specific conversion factors are needed. While we understand why GM would prefer that EPA establish a single

conversion factor for the entire industry to use in the program, we currently do not believe such a factor would be adequately representative given the differences among engines and vehicles. In general, we are requiring manufacturers to develop an engine/vehicle specific conversion factor based on test data. The conversion factor must be approved by EPA on a case by case basis prior to any transfer of credits.

We are proceeding conservatively by allowing credits to be transferred only as part of Options 1 and 2 which provide additional emission reduction benefits. In addition the time frame for transferring credits is limited. We believe these limitations are appropriate to ensure the integrity of the ABT programs. With these restrictions, we do not believe the provisions will have negative impact on the emissions performance of the program overall. We believe the provisions may be beneficial to the environment to the extent they provide an incentive for manufacturers to select Options 1 or 2. In addition, the program may provide EPA and manufacturers with valuable data and experience in the area of engine and vehicle-based testing comparisons.

COMMENT B: We received comments on our proposal to allow engine-based credits to be generated up to a ceiling of 2.0 g/bhp-hr NOx. Manufacturers (EMA, Ford) recommended that the ceiling should be adjusted upward to 3.0 g/bhp-hr, in conjunction with a NOx plus NMHC engine standard higher than the 1.0 g/bhp-hr standard proposed. Manufacturers commented that the they would be unable to meet emissions levels below 2.0 g/bhp-hr NOx in order to generate credits. Ford notes that the 2.0 g/bhp-hr ceiling provides little or no opportunity to generate early credits because improved catalyst technology that provides the needed durability may not be available. Ford also notes that it is unfair that otto-cycle manufacturers must be below half the current 4.0 g/bhp-hr NOx standard before they are able to generate credits. We also received comments (Wasatch Clean Air Coalition, NESCAUM) supporting our proposal. One commenter (Wasatch Clean Air Coalition) supported EPA's proposal, stating that EPA should tighten the ABT system so that manufacturers cannot generate excessive credits. **(Engine Manufacturers Association (IV-D-05), Ford Motor Company (IV-D-08), Wasatch Clean Air Coalition (IV-D-40), NESCAUM (IV-D-26))**

RESPONSE: Given the very low certification levels being achieved by Otto-cycle engines, we remain concerned about the potential for large pools of credits to be banked prior to implementation of the standards. Although certification levels may be higher than they are currently when adjusted to account for more severe deterioration, they potentially could remain well below 3.0 g/bhp-hr. If we adopted a ceiling of 3.0 g/bhp-hr, as manufacturers are suggesting, manufacturers could potentially bank significant amounts of credits without any changes to the current engines. Large pools of credits could be used to significantly delay the implementation of the standards for a large portion of the manufacturers product line. Therefore, we are retaining the 2.0 g/bhp-hr ceiling as proposed. We believe this ceiling will allow for credit generation through the development of superior technologies while curbing the ability of manufacturers to bank large sums of credits based on the use of current technologies.

COMMENT C: One commenter recommended that EPA establish a NOx plus NMHC limit of 2.0 g/bhp-hr as the maximum allowable level for engines using credits in 2004 and later model years. EPA proposed 4.0 g/bhp-hr as the upper limit. The commenter believes that 2.0 g/bhp-hr is appropriate because it is twice the standard (1.0 g/bhp-hr) and within reach of the 1998 technology. **(Wasatch Clean Air Coalition (IV-D-40))**

RESPONSE: We are retaining the upper limit of 4.5 g NOx plus NMHC as proposed. The ABT programs remain consistent in the treatment of Otto-cycle engines and diesel engines on this point. While we have finalized differing Otto-cycle and diesel engine standards and ABT program provisions, we have done so due to specific concerns (for example, to ensure the standards are consistent with the CAA requirements and to ensure the ABT program does not provide a large windfall of credits). For this provision regarding credit use, we believe it is most appropriate to remain consistent with the approach taken for diesel heavy-duty engines. We have not identified particular concerns for Otto-cycle engines that would cause us to treat Otto-cycle engines differently with regard to the upper limit. Manufacturers do not have any incentive to "backslide" from their current federal certification levels. Manufacturers are unlikely to expend the credits that would be necessary to set an FEL as high as 4.5 g/bhp-hr NMHC plus NOx given current certification levels. However, while we do not anticipate manufacturers using credits in this manner to establish FELs as high as 4.5 g/bhp-hr, we are concerned that adopting a level lower than 4.5 g/bhp-hr such as the 2.0 g level recommended by the commenter could disrupt product plans for the 2004 model year.

COMMENT D: EPA received comment from manufacturers (EMA, Ford) that we should not require revised deterioration factors (DFs) for engines generating credits prior to 2004. The commenters note that requiring new deterioration factors for engines banking early credits will shorten the lead time available for generating early credits. The commenters estimate that it will take three years to develop the new DFs, and, therefore, that the new DFs would not be available until December 2002. **(Engine Manufacturers Association (IV-D-05), Ford Motor Company (IV-D-08))**

RESPONSE: We are finalizing the DF requirements as proposed. We believe that the use of DFs representing a significant majority of deterioration is critical to preserving the integrity of the ABT program as lower emissions standards are implemented in the future. The ABT program allows manufacturers to establish their FELs as low as the certification level. We believe the revised DF requirements help ensure that manufacturers establish FELs appropriately and helps avoid in-use compliance failures. It also helps address issues of compliance margin shaving by manufacturers which are often raised with regard to the ABT program. We do not believe that the use of revised DFs for credit generation diminishes the amount of credits available for a given engine family since manufacturers should account for the higher deterioration when setting their FEL in any case.

The requirement could, however, delay manufacturers from earning early credits for a year or two. We believe that manufacturers will be able to use DF methodologies that allow them to establish DFs in a shorter time frame than suggested in the comments. Manufacturers have flexibility in establishing DF procedures under the current regulatory provisions and accelerated aging methods have been developed. Manufacturers have experience using accelerated aging methods under the CAP 2000 program for light-duty vehicles and in some cases have used these methods for certifying heavy-duty engines. In addition, the three implementation options for the engine standards we have adopted provide additional flexibility, which diminishes the need for early credit generation. Options 1 and 2 contain a higher standard and allow credit transfers between the vehicles and engines ABT programs (see issue A). Option 3 provides an additional year (2004) for early credit generation. Even if the requirement to use revised DFs delays a manufacturer's ability to generate early credits, we believe there is still substantial opportunity to use the ABT program during the implementation of the engine standards.

COMMENT E: One Commenter (NESCAUM) raised concerns that manufacturers have little incentive to establish FELs at appropriate levels due to the lack of a credible enforcement program

to identify engine families which are not achieving their certification levels in-use. They commented that manufacturers have an incentive to "shave" their compliance margins in order to maximize banked credits. **(NESCAUM (IV-D-26)**)

RESPONSE: In recent years, there has been only very limited use of the ABT program by Otto-cycle engine manufacturers and margin shaving has not been an issue. However, with the implementation of lower standards, the use of ABT may increase substantially. We concur that in-use testing is important to ensuring the full benefit of lower emissions standards overall, including the ABT program. Margin shaving can be a concern not only in the context of the ABT program but with emissions standards in general. In-use testing is the most appropriate way to ensure that manufacturers are providing themselves with adequate compliance margins. As discussed in Issue 27, we plan to work with other interested parties to develop a proposal for in-use testing of heavy-duty engines in the future. For heavy-duty vehicles certified to vehicle-based standards, CAP 2000 contains in-use testing requirements.

In addition, to help address concerns regarding margin shaving, we are requiring manufacturers to use revised DFs for any engine family used to generate early credits (see response to Comment D). The new DFs must represent a significant majority of deterioration. Manufacturers have commented that they currently certify with DFs representing average deterioration but target certification emissions level well below the standard to account for more severe deterioration. However, there currently is no requirement for manufacturers to leave themselves with large compliance margins. Using revised DFs representing a significant majority of deterioration will most likely produce a higher certification level and therefore smaller compliance margins. However, the certification levels essentially will be more representative of what manufacturers would expect in-use from the majority of the engines in a given family. With this more representative certification level, there would be less opportunity for maximizing credits by reducing compliance margins.

COMMENT F: Commenters (NESCAUM, STAPPA/ALAPCO) are concerned that changes such as removing credit life limits and discounts will reduce the incentive to introduce clean engine technology. One commenter (STAPPA/ALAPCO) suggests that CARB's discounting and term life limits for credits would serve as a useful model for the ABT program. **(NESCAUM (IV-D-26)**, **STAPPA/ALAPCO (IV-D-32))**

RESPONSE: We believe we have structured the ABT programs for Otto-cycle engines and vehicles in such a way as to provide incentive for manufacturers to introduce clean technology early. To earn early credits, manufacturers must achieve emissions levels well below the current standards. To earn undiscounted credits manufacturers must achieve an even lower level. In the Otto-cycle engine ABT program, manufacturers must achieve a level below 2.0 g/bhp-hr NOx to earn any credits and must achieve a level below 1.0 g/bhp-hr NOx to earn undiscounted credits. This approach deviates from the diesel HDE ABT program which allows manufacturers to generate credits up to 4.0 g/bhp-hr NOx (for the reasons described in our response to B). We believe that by establishing these lower cut points for Otto-cycle engines we will ensure that credits will be generated through the use of technologies that are superior to the average technology used today. The ABT program has been designed to prevent large windfalls of credits which could be used to significantly delay the implementation of the standards (See response to B and D). We also believe that adding further limits on the program such as credit life limits and more extensive discounting would discourage manufacturers from introducing technology early.

The ABT program provides flexibility that enables manufacturers to meet the new standards earlier than may otherwise be feasible. The new standards are not phased-in over more than one model year. The new standards apply to the manufacturers entire product line during the first year of implementation. The ABT program finalized in this rule provides some flexibility to manufacturers to allow them to smoothly transition their product line to the new standards without a phase-in of the standards.

COMMENT G: Commenters are concerned about the ABT program impacting the ability of consumers and states to determine the emissions standards that are applicable to a vehicle. One commenter (STAPPA/ALAPCO) recommends that engines and vehicles be clearly labeled with the standards to which it is certified so that consumers are aware of this information. Another commenter (NESCAUM) raised concerns that the ABT program could interfere with the development of effective state in-use inspection and maintenance programs. They are concerned that states could have difficulty establishing cut-points because the manufacturers can certify engines to many different emissions levels through the ABT program. **(NESCAUM (IV-D-26)**, **STAPPA/ALAPCO (IV-D-32))**

RESPONSE: EPA regulations currently require that engines certified to an FEL, rather than the standard, be labeled with the FEL.[31] Otherwise, the label must state that the engine is certified to the applicable standards. For vehicles, CAP 2000 similarly includes requirements that vehicles be labeled with the exhaust emissions standards to which they are certified. We have modified the wording of the CAP 2000 requirement to reflect that heavy-duty vehicles may be certified to an FEL and must be labeled accordingly.

The concern raised by NESCAUM regarding the ability of manufacturers to certify to many different levels is a concern about the structure of the current ABT program rather than a concern about the modifications to the program that we proposed. The current program, which has been in place for several years, allows manufacturers to set an FEL at any emissions level within the bounds of the program. We did not propose or consider modifications to the program that would limit the selection of the FEL (except that we proposed to adjust the upper limit for FEL). In addition, we did not propose any changes to the ABT program for diesel engines. It is not clear if this is a potential issue for diesel engines or if it is limited to Otto-cycle engines.

We did not consider this issue in the proposed rule because we are not aware of any cases where states have had difficulty in developing or implementing an I/M program for heavy-duty engines due to the ABT program. If we learn of specific instances in the future where the structure of the ABT program may be hindering state efforts to adopt I/M programs, we would consider ways of addressing the issue. In addition, we are also finalizing OBD II requirements for vehicles up to 14,000 pounds GVWR which may affect the way in which states design I/M programs and may help address this potential issue. The OBD II system will help identify emissions control system failures and needed repairs.

[31] 40 CFR 86.094-35(a)(3)(iii)(L) and (M).

ISSUE 18: DETERIORATION FACTORS (DFs) FOR OTTO-CYCLE ENGINES

COMMENT A: EPA proposed to require that certification DFs represent a significant majority of in-use deterioration. Manufacturer comments indicate that their current DFs represent average deterioration (50th percentile). EMA notes that manufacturers currently target emissions levels well below the standards to ensure that the 90th percentile vehicle complies with the standard in-use. EMA further notes that, in fact, manufacturers use deterioration factors during development testing that are much larger than those used for certification.

Some manufacturers (Daimler Chrysler, GM) commented that the proposal would increase the stringency of the standard. GM comments that because the engines are used in work vehicles, the change results in a significantly more stringent standard. Daimler Chrysler indicates that they design vehicles such that the weighted average of the vehicle population is at half the standard. Daimler Chrysler indicates that they would need a larger design margin due to the change in the DF in order to maintain a certification level at half the standard. The commenter provides figures to help demonstrate their concerns. Daimler Chrysler recommends not finalizing the revised DF requirements. **(Daimler Chrysler (IV-D-44), General Motors Corporation (IV-D-65), Engine Manufacturers Association (IV-D-05))**

RESPONSE: We reject the claim that the revised DF requirements will increase the stringency of the standards. EMA has commented that manufacturers already target emissions levels such that the worst case (90th percentile) vehicle complies with the standards. (See IV-D-05). This is part of the reason certification levels are low relative to the applicable standards. The revised deterioration factor requirements are consistent with current industry engine design practices. The revised procedures will ensure that certification levels are representative of the majority of vehicles rather than the average vehicle.

Daimler Chrysler claims that the revised procedures will increase the stringency of the standards because manufacturers will maintain compliance margins of the same level relative to the standard that they use currently. We would expect that the compliance margins could be reduced to the extent the current margins are maintained today to cover more severe deterioration. Maintaining a compliance margin to cover more severe deterioration and using a deterioration factor that is representative of the same severe deterioration would be redundant. We would expect a compliance margin to be maintained as a safety cushion and the level of this compliance margin would depend on each manufacturer's view of in-use risk relative to a given engine family.

COMMENT B: Commenters provided comments that the new DF requirements hinder manufacturers ability to earn early ABT credits. **(Engine Manufacturers Association (IV-D-05), Ford Motor Company (IV-D-08))**

RESPONSE: The summary and analysis of these comments are contained in Issue 17 (D).

COMMENT C: One commenter recommends that EPA allow the use of additive DFs rather than requiring the use of multiplicative DFs. The commenter notes that as the standards are becoming more stringent the multiplicative DFs are becoming less reliable for certification. The 4,000 mile levels are becoming very low, resulting in increased test-to-test variability. When the low mileage level is divided into the 120,000 mile level the resulting DF is highly variable and inaccurate. **(Ford Motor Company (IV-D-08))**

RESPONSE: It is not clear that an additive DF would better predict in-use emissions levels. We agree that if the variability in the low mileage emissions level remains the same while the emissions level itself is reduced then the DF would become more variable. However, if the variability decreases at the same rate as the emissions level, then the DF would not become more variable. Manufacturers can address this issue by taking steps to reduce variability. For these reasons, we are not adopting the approach recommended by the commenter.

We will, however, allow the use of an additive DF if it is demonstrated to better predict in-use emissions levels. If a manufacturer believes that an additive deterioration factor would produce certification results that are more representative of in-use emissions levels, we will allow manufacturers to use the additive deterioration factor upon pre-approval from EPA. In addition, we are requiring manufacturers using an additive DF to conduct in-use testing to verify that the additive deterioration factor better predicts in-use emissions levels. The plan for the in-use testing verification program also must be approved by EPA prior to the use of the additive DF. EPA would consider the test results in granting the future use of additive DFs, but could also use the results for enforcement purposes, including in support of a recall if the engine family is found to exceed the applicable standards. Also, we expect that these manufacturer in-use testing efforts could eventually fit within an overall in-use testing program which we are currently considering, as described in Issue 27.

ISSUE 19: COMPLIANCE ASSURANCE PROGRAM 2000 (CAP 2000)

COMMENT A: Two commenters supported our proposal to include complete heavy-duty vehicles in the CAP 2000 compliance program (EMA, NESCAUM). One commenter supported our proposals to allow incomplete vehicles to certify according to the CAP 2000 provisions and to group different weight vehicles into the same test group as long as all vehicles in a given test group met the most stringent standards applicable to any of them (Wisconsin DOT). One commenter noted that we referenced an out of date SAE procedure (SAE J1892, "Recommended Practice for Bar-Coded Vehicle Emission Configuration Label (May 1988)), and suggested that we use the latest revision of the procedure (Ford). One commenter recommended that we improve the definition of "complete vehicle" in order to clarify which vehicles are subject to the CAP 2000 provisions (Workhorse). Finally, two commenters noted that a petition for reconsideration of the original CAP 2000 regulations has been filed. These commenters stated that it would be inappropriate for us to include complete heavy-duty vehicles in the CAP 2000 program until after the resolution of that petition (Ethyl, automotive aftermarket trade organizations). We also received additional late comments further supporting the petition for reconsideration of the original CAP 2000 regulations (Ethyl, automotive aftermarket trade organizations). **(EMA (IV-D-05), Ford (IV-D-08), Wisconsin DOT (IV-D-17), NESCAUM (IV-D-26), Workhorse (IV-D-30), Ethyl (IV-D-66, IV-D-141), automotive aftermarket trade organizations (IV-D-75, IV-D-111))**

RESPONSE: We agree that the most recent SAE procedures should be used, and have updated the final rule to reference the September, 1998 version of SAE J1892. We have also modified our definition of complete vehicle to include the idea that the vehicle is complete if its primary load carrying container or device is attached at the time it leaves control of the entity which manufactured the engine. Under the proposed definition, every heavy-duty vehicle would have been considered a complete vehicle at some point in time because they would all eventually have the load carrying container or device attached in order to make them functional. However, our intention was to consider vehicles to be complete vehicles only if they were manufactured to completion by a single entity. We believe the best way to do this is to include in the definition a reference point of time at which to apply the definition. Thus, if separate entities manufacture the engine and the chassis, or if separate entities manufacture the engine/chassis combination and install the primary load carrying container or device, we would not consider such vehicles to be complete vehicles for purposes of applying the chassis-based standards and the CAP 2000 compliance program because they would not be complete at the time the vehicle left control of the engine manufacturer.

The CAP 2000 program involves the kind of procedures used by the vehicle manufacturer to determine the rate of emissions deterioration that can be expected for their product over its useful life, the time period during which it must comply with the emissions standards. This emissions deterioration rate is then used in conjunction with low mileage emissions levels to project whether the engine family at issue can be expected to comply with the applicable emissions standard over the full useful life. The durability procedures are therefore one of several core elements of the certification process for the vehicle manufacturer. The CAP 2000 procedure were originally developed for manufacturers of light-duty vehicles and trucks. They allow the manufacturer to develop their own durability procedure, and have it approved by EPA if it meets various criteria designed to show that the procedure appropriately predicts in-use deterioration for that engine family. The manufacturer must also conduct an in-use test program as an additional check on the effectiveness of the procedure in predicting in-use deterioration.

The CAP 2000 procedures have been used by light-duty vehicle and truck manufacturers, primarily involving Otto-cycle vehicles, typically gasoline fueled, with catalyst aftertreatment. The heavy-duty vehicles that would be subject to the CAP 2000 procedures under this rule are also Otto-cycle engines, typically gasoline fueled, and will typically rely on catalytic converter aftertreatment. The same or similar kinds of emissions control hardware and emissions control strategies that are currently found in Otto-cycle light-duty vehicles and trucks will also be used in the Otto-cycle heavy-duty vehicles subject to this rule. Many of the manufacturers of heavy-duty Otto-cycle vehicles are also light-duty manufacturers. Given the similarities in emissions technology, emissions control strategy, and vehicle manufacturers, at this time EPA believes it is appropriate to apply the same kind of durability regulatory provisions to both the light and heavy duty Otto-cycle vehicles. EPA is not aware nor have commenters raised any reasons to treat them differently. Comments not supporting the proposal also suggest they should be treated the same, at least to the extent that commenters clearly believe CAP 2000 procedures are inappropriate for both light and heavy-duty vehicles.

The CAP 2000 procedures currently apply to the certification of light-duty vehicles and trucks. EPA explained the reasons for adopting those procedures in that rulemaking. See 64 FR 23906 (May 4, 1999), and related RIA and Response to Comments. EPA has received and is currently evaluating a petition to reconsider those procedures. The petition and related public comments raise many of the same issues raised by commenters in this rulemaking. EPA expects to take action on that petition in the near future.

EPA generally believes that the CAP 2000 provisions should apply in the same way to both light-and heavy duty Otto-cycle vehicle manufacturers. Since the issues raised in the rulemaking comments are the same as those raised in the petition, and raise no issues unique to heavy-duty vehicles, EPA believes it is most appropriate to resolve them in that Agency action. Any decision to deny or to grant reconsideration would then cover both light-and heavy-duty vehicles. Adoption of the CAP 2000 procedures for heavy-duty vehicles at this time will appropriately apply the same durability provisions to light and heavy duty Otto-cycle vehicles. To the extent commenters raise issues that were addressed when EPA finalized the CAP 2000 rule, EPA relies on the rationale and response to comments presented in that rulemaking. To the extent commenters raise issues that were not addressed when EPA finalized the CAP 2000 rule, the issues are the same or similar to those before the Agency on the petition to reconsider the CAP 2000 rule and will be addressed there. That will allow the Agency to most efficiently coordinate and consistently address the durability provisions for light and heavy duty vehicles.

ISSUE 20: ON-BOARD DIAGNOSTICS SYSTEMS

Issue 20.1: Technological Concerns

COMMENT A: Diesel catalyst monitoring is unnecessary and technologically infeasible. Diesel catalyst monitoring is less critical to ensuring in-use compliance than monitoring of gasoline-engine catalysts. Diesel catalysts are relied upon to reduce emissions much less than their gasoline-engine counterparts. Diesel catalysts have much lower conversion efficiencies and even complete failure of the catalyst is unlikely to result in emission levels in excess of the emissions threshold. Diesel catalyst durability data demonstrates very good catalyst performance at and beyond useful life. The delta temperature method of catalyst monitoring cannot measure small temperature differences across a diesel catalyst to detect deterioration. The delta pressure method is incapable of detecting catalyst deterioration at a specific emissions threshold. And, the NOx sensor technique for direct NOx measurement of reduction catalysts will not be feasible for production by the 2004 model year. These sensors are expected to be expensive at approximately forty dollars ($40) per sensor. **(Engine Manufacturers Association (IV-D-05), Ford Motor Company (IV-D-08), Navistar International Transportation Corp. (IV-D-29), DaimlerChrysler Corporation (IV-D-44), Volkswagen of America (IV-D-51), General Motors Corporation and Isuzu Motors America, Inc. (IV-D-65))**

RESPONSE: We don't agree with the comments that the delta temperature or delta pressure methods cannot detect catalyst deterioration. However, limited data on diesel oxidation catalyst durability presented to the Agency from an engine manufacturer[32] supports the comments that diesel catalyst durability is very good. The data suggests that for diesel oxidation catalysts, there is essentially no deterioration up to 120,000 miles. Although we believe diesel oxidation catalysts can be effectively monitored, we agree with the commenters that diesel oxidation catalysts will not be heavily relied upon to reduce emissions and that they will experience minimal to no deterioration over the vehicle's useful life. Therefore, in light of these comments and the above mentioned data, we feel it is appropriate at this time to not require diesel oxidation catalysts to be monitored.

As for diesel reduction catalysts, we feel that they may play an important role for future light-duty vehicle applications, especially in meeting Tier 2 emission standards. Information from catalyst technology literature[33] indicates that diesel reduction catalysts are not nearly as durable as diesel oxidation catalysts. Thus, if a manufacturer were to rely on a reduction catalyst to meet today's final standards, it is imperative that they be monitored. We disagree with comments suggesting that technology needed to monitor diesel reduction catalysts will not be ready by the 2004 model year. We believe that manufacturers will be capable of monitoring diesel reduction catalysts to the required emissions threshold by using multi-layered, thick film zirconia NOx sensor technology. The principle of operation for these NOx sensors is based on two stages. During the first stage, the oxygen concentration in the measuring gas (i.e., the exhaust) is lowered to a predetermined level with an oxygen pumping cell. In the second stage, another pumping cell further lowers the oxygen concentration which results in simultaneous NOx decomposition. The second stage pumping

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[32] Memo to EPA Air Docket A-98-32 from William Charmley dated October 12, 1999. A-98-32, II-B-06.

[33] Discussion on diesel lean NOx catalysts from www.DieselNet.com.

current is proportional to the NOx concentration in the measuring gas, thereby providing a measurement of NOx concentration. There are several technical papers[34] that suggest NOx sensor technology is feasible and should be available prior to the 2004 model year.

COMMENT B: Particulate sensor technology that would be required to measure particulate matter (PM) concentrations in particulate traps does not exist. The delta pressure technique, which could potentially be effective in detecting a cracked-trap for burner-assisted traps only, is not capable of monitoring to an emission threshold. EPA should exclude emissions-threshold monitoring for PM traps and, at most, only require presence detection for burner-assisted PM traps. **(Engine Manufacturers Association (IV-D-05), Ford Motor Company (IV-D-08), Navistar International Transportation Corp. (IV-D-29), DaimlerChrysler Corporation (IV-D-44), Volkswagen of America (IV-D-51), General Motors Corporation and Isuzu Motors America, Inc. (IV-D-65))**

RESPONSE: We believe these comments to be reasonable and have decided that for the final rule, manufacturers will not be required to monitor the particulate trap to an emission threshold. Rather, they must monitor for the complete failure of the device. We define complete failure as a sudden drop in exhaust back-pressure below that of a clean or unloaded trap under monitoring conditions specified by the manufacturer. This can be achieved by using a delta pressure sensor.

COMMENT C: EPA should adopt, consistent with California's existing requirements, an emissions threshold level for catalyst monitoring of 1.75 times the HC standard for otto-cycle heavy-duty vehicles and engines below 14,000 lbs. GVWR. Failure to harmonize this threshold will result in manufacturers needing different OBD programming for 49-state versus California (50-state) vehicles. **(Engine Manufacturers Association (IV-D-05), Ford Motor Company (IV-D-08), DaimlerChrysler Corporation (IV-D-44))**

RESPONSE: We chose to have the catalyst monitor emission threshold level for heavy-duty vehicles and engines under 14,000 lbs. GVWR be 1.5 times the NMHC standard over the 4,000 mile emissions level because this is consistent with the federal light-duty OBD requirements. We believe that, although the California and federal thresholds are numerically different, they are of very similar stringency. This is because of the manner in which the numerical thresholds are applied. The federal OBD regulations state that the catalyst must be monitored for deterioration or malfunction "before it results in an *increase* in NMHC emissions 1.5 times the NMHC+NOx standard or FEL, *as compared to the NMHC+NOx emission level measured using a representative 4000 mile catalyst system*" (emphasis added). The California requirements state that the emission threshold shall be "1.75 times [the standard], *which shall not include the emission level with a 4000 mile catalyst system*" (emphasis added). These two approaches result in threshold emission levels that are mathematically very close, although dependent upon assumptions regarding the typical 4000 mile emission level. For example, for a vehicle between 8,500 and 10,000 lbs GVWR that must certify to an NMHC standard of 0.28 g/mi, the 4,000 mile certification level might be 0.14 g/mi. Given this, the federal requirement would, in this case, require illumination of the MIL at a threshold of 0.56 g/mi [(1.5 x 0.28) + 0.14 = 0.56]. In comparison, the California requirements would require illumination of the MIL when emissions reached 0.49 g/mi [1.75 x 0.28 = 0.49]. Although these thresholds are not equivalent, their stringency is not as different as the wording of the threshold requirements might imply.

[34] SAE 1999-01-0202; SAE 980170; SAE 970858; SAE 960334.

Additionally, we believe it would be very unlikely that the federal threshold would ever be more stringent than the California threshold. Referring to the above example, the only way the federal threshold would be more stringent than the California threshold is if the 4,000 mile certification level is less than 0.05 g/mi NMHC [(1.5 x 0.28) + 0.05 = 0.49)]. Such a low level seems unlikely given the level of the NMHC emission standard. As a result, the likelihood of a California system not meeting the federal requirement seems very small, as the California system will almost certainly be designed to a more stringent threshold. Therefore, it is hard to imagine why different OBD programming for 49-state versus California (50-state) vehicles would be required. As with the light-duty OBD regulations, we feel that a vehicle equipped with a catalyst monitor designed to meet the California OBD requirements (1.75 times the HC standard) will meet our requirements. In addition, the final rule contains provisions that allow demonstration of compliance with the California requirements to satisfy the requirements in the federal regulations, an option that manufacturers are expected to take advantage of.

COMMENT D: EPA should specify that the responsibility to ensure that evaporative emissions are monitored by the OBD system rests with the OBD system designer and not the entities that purchase those engines for use in their specific vehicles. **(Arent Fox (IV-D-30))**

RESPONSE: The regulations are clear that the responsibility for monitoring all emission-related engine systems or components during the applicable useful life fall on the manufacturer of the heavy-duty engine or vehicle. However, if someone purchases certified heavy-duty engines and/or vehicles and modifies them to make a distinct and unique vehicle from the certified original for sale such that the OBD system no longer functions as intended, the party who has made the modifications to the heavy-duty engine or vehicle would be required to certify the new modified OBD system.

COMMENT E: The commenter believes that the OBD requirements need to be designed to conform with the Society of Automotive Engineers (SAE) standard J1939 for heavy-duty vehicles. They argue that truck owners do not need an additional set of standards, test protocols, fault codes and scanning tools created for this requirement, and question whether EPA's recommended use of SAE J1850, ISO 9141-2, SAE J1962, SAE 20212, and SAE J1979 is appropriate for heavy-duty engines. **(American Trucking Association (IV-D-21))**

RESPONSE: Neither the proposed rule nor the final rule specifically recommends the use of a particular SAE standard. Rather, the rule provides more than one option for manufacturers to select from. These requirements mimic the California OBD requirements, which have been in place since the 1996 model year, and which, to our knowledge, have not created significant issues for truck owners regarding the standardized protocols, fault codes, and scan tools. In fact, SAE J1939 was essentially designed by the heavy-duty diesel manufacturers to resolve issues of standardization in heavy-duty diesel engines absent any federal OBD requirements, and is in widespread use in the heavy-duty market segment today. We are certainly not requiring or recommending that heavy-duty engine manufacturers change their current practice and transition to a different SAE standard than the one they are currently using; in fact, we encourage them to use the SAE standard that they designed to meet their needs, SAE J1939. However, we are allowing the alternatives to SAE J1939 because heavy-duty gasoline manufacturers, more familiar with the light-duty gasoline SAE practices such as SAE J1850, J1979, etc., are now using those SAE standard practices. Heavy-duty diesel manufacturers now use SAE J1939. The regulatory language that was proposed, and that is promulgated in the final rule, provides maximum flexibility to all manufacturers without

disrupting current practices and serving the needs of the service tool and repair industries.

Issue 20.2: On-board Diagnostics Phase-in

COMMENT A: EPA has proposed separate phase-in periods for engines and vehicles to meet the OBD requirements. This proposal is burdensome. Full product-line manufacturers typically have few engine dynamometer engine families. Under EPA's proposal, manufacturers with only one engine family in the engine dynamometer category would be forced to meet OBD requirements in the first year of phase-in. Therefore, EPA should allow for a single OBD phase-in for engine- and chassis-certified vehicles and, manufacturers with a single heavy-duty engine family should not have to implement OBD requirements until the 2007 model year. **(Engine Manufacturers Association (IV-D-05), Ford Motor Company (IV-D-08))**

RESPONSE: We agree with the comments. We will allow for a single heavy-duty phase-in for engine- and chassis-certified vehicles. We will also allow for a manufacturer with a single heavy-duty engine family to wait until the 2007 model year to implement the OBD requirements. However, it should be pointed out that the intent of this allowance is for a manufacturer who has a single engine configuration and single engine family, not one engine configuration with multiple engine families.

Issue 20.3: Deficiencies

COMMENT A: EPA should provide for hardware-based deficiency allowances, along with an allowance for manufacturers to carry over the deficiency for up to two years. If it can be adequately demonstrated that substantial vehicle hardware modifications and additional leadtime beyond two years would be necessary to correct the deficiency, the deficiency may be carried over three model years. EPA should also allow for up to two deficiencies per engine family. **(Engine Manufacturers Association (IV-D-05), Ford Motor Company (IV-D-08), Navistar International Transportation Corp. (IV-D-29))**

RESPONSE: The deficiency allowances for heavy-duty vehicles in this final rule are the same as for light-duty vehicles. We feel that it is very important for the heavy-duty and light-duty OBD regulations to be consistent. As with the light-duty OBD regulations, we allow hardware-based allowances as well as software-based allowances. What we don't allow is the lack of a monitor. For example, a manufacturer can't request a deficiency on a diesel reduction catalyst because they don't know how to monitor it. However, if they show that a good faith effort has been made and that while the monitor will not monitor to the specified emission threshold, it will work to some lesser level, a deficiency may be granted. We also feel that it is inappropriate to make a general blanket statement allowing carry-overs. If our regulations allow carry over for one, two or even three model years, we believe it would encourage some manufacturers to not put forth a good faith effort in developing a compliant OBD system. However, if an individual manufacturer makes a good faith effort and has a compelling rationale why a particular deficiency still exists, we have the authority to consider granting a deficiency the following year.

Issue 20.4: OBD Test Cycle

COMMENT A: EPA indicated that its intent was to base the OBD emissions threshold levels for heavy-duty diesel engines on the FTP transient test procedure only. 64 Fed. Reg. at 58509.

However, the regulatory language fails to include the Euro III test in the expressly excluded supplemental test procedures. 64 Fed. Reg. at 58542; proposed Section 86.004-17 (b). By omission, this indirectly suggests that the emissions threshold also should be on the Euro III test procedure. EPA should clarify the regulatory language such that the emissions threshold for heavy-duty diesel engines is based on the FTP transient test procedure only. **(Engine Manufacturers Association (IV-D-05), Ford Motor Company (IV-D-08))**

RESPONSE: This was an oversight. We will clarify the regulatory language such that the emissions threshold for heavy-duty diesel engines is based on the FTP transient test procedure only.

Issue 20.5: OBD for Vehicles Over 14,000 lb. GVWR

COMMENT A: EPA should extend the OBD requirements beyond the 14,000 pound range. One commenter argued that heavy-duty vehicle and engine manufacturers have developed electronic devices which will detect and alert the driver of engine malfunctions which adversely effect fuel economy and driveability. **(Commonwealth of Massachusetts (IV-D-12), American Lung Association (IV-D-19), Northeast States for Coordinated Air use Management (NESCAUM) (IV-D-26), Coalition for Clean Air (IV-D-53), International Center for Technology Assessment (IV-D-61), Environmental and Energy Study Institute (IV-D-77))**

RESPONSE: As discussed in the preamble, there are many potential issues associated with applying OBD requirements to >14,000 lb GVWR applications that have not been of similar concern regarding smaller vehicles. For example, trucks this large tend to be equipped with power take-off units that are operable a substantial portion of the time. Examples are refrigerator trucks, garbage trucks, or cement mixers. Such vehicles often use engine power to operate the refrigeration unit, the compactor, or the cement mixer, in addition to powering the vehicle as it drives down the road. Such devices, powered off the engine, are referred to as “power take-off units.” Both CARB and EPA regulations currently allow disablement of most OBD monitors during power take off unit operation. This has been of little concern for smaller vehicles, because of the very small percentage of vehicles in the 14,000 lb. GVWR and under weight range that use such units for a substantial portion of their operation. However, this approach to OBD monitoring during power take-off unit operation is problematic for larger engines that use power take-off units during substantial portions of their operation. It makes little sense to require a sophisticated OBD system on a vehicle if it’s allowed to remain disabled during essentially its entire operation due to the power take off unit.

This represents just one issue which, while it can be effectively dealt with, requires more time and cooperative efforts with industry and others to develop a meaningful and effective set of OBD regulations. Another such issue is the lack of vertical integration in the heavy-duty industry, particularly in the >14,000 pound GVWR classes. This lack of vertical integration creates increased difficulty associated with bringing together engine, transmission, chassis, and safety related diagnostics because so many different manufacturers are involved in creating the end product. For that reason, we are not requiring OBD requirements for >14,000 pound GVWR engines at this time. We will gather further information and work closely with interested parties during the coming months to develop proposed OBD requirements for such engines.

Issue 20.6: Service Information

COMMENT A: Commenters urge EPA to require medium-duty manufacturers to follow the

information availability regulations set forth for the light-duty vehicle manufacturers. Commenters also urged EPA to reconsider its decision not to require manufacturers to provide information needed to build OBD compatible parts. **(Automotive Aftermarket Industry Association, Automotive Engine Rebuilders Association, Automotive Parts Rebuilders Association, Coalition for Auto Repair Equality, Heavy Duty Manufacturers Association, Heavy Vehicle Maintenance Group, Motor & Equipment (IV-D-75), Automotive Service Association (IV-D-80))**

RESPONSE: The final heavy-duty OBD regulations require manufacturers to provide available diagnostic data. This includes diagnostic trouble codes, freeze frame engine conditions and engine coolant temperature, fuel control system status, fuel trim, ignition timing advance, intake air pressure, air flow rate, manifold air pressure, engine RPM, throttle position sensor output value, secondary air status, calculated load value, vehicle speed, and fuel pressure.

EPA has also required that this information be accessible through uniform connectors, that access to the connectors be unrestricted, and that the information be provided in a set format without any need for unique decoding, thus fulfilling our requirements under section 202(m)(4). Additional information required under section 202(m)(5) would fall under the service information availability regulations. (40 C.F.R. § 86.094-38). We did not propose to revise the service information regulations in the NPRM for this rule, so it would be inappropriate to finalize any such changes without further notice and comment. EPA does not agree that the current Service Information regulations apply to heavy duty engines, with the exception of Medium Duty Passenger Vehicles, which are subject to roughly the same regulations as LDTs under the Tier 2 rule. The Service Information rule explicitly referred only to "requirements for the availability of emission-related service information for all light-duty vehicles (LDVs) and light-duty trucks (LDTs)." 60 FR 40474 (August 9, 1995). Though the regulations are ambiguous on this issue, the preamble is clear. EPA agrees that, as manufacturers of heavy duty vehicles and engines below 14,000 pounds will now be required to equip their engines and vehicles with OBD systems, they apparently should also be subject to service information rules. However, EPA does not believe that the rules governing service information requirements for such manufacturers need to be promulgated at the same time as the rules for OBD. Nothing in section 202(m)(5) of the Act indicates that the two sets of regulations, which are clearly written as distinct regulations in the Act, need to be promulgated at the same time. Contrast section 202(m)(5)'s requirements with those of section 202(m)(4), which clearly contemplate that the regulations under section 202(m)(4) will be promulgated at the same time as those under section 202(m)(1). The regulations governing service information have generally raised significant issues distinct from the issue raised in OBD regulations. It is therefore appropriate that EPA undertake such actions in a separate proceeding. Indeed, EPA's initial service information regulations were issued over two years after its initial OBD regulations. EPA intends in the near future to review its service information regulations to determine what service information regulations (if any) are appropriate for heavy duty vehicles and engines below 14,000 pounds.

Regarding commenters request for EPA to reconsider its previous decision not to require manufacturers to provide information needed to build OBD compatible parts, EPA does not believe it is appropriate to address such issues in this rule. We did not propose any change in our service information regulations and any such changes would have to proceed after notice and comment. Commenters are free to raise this point in any later proceeding that is more connected to that issue.

Issue 20.7: Inspection/Maintenance (I/M) Programs

COMMENT A: A commenter requested that EPA give careful and thoughtful consideration to the OBD requirements for heavy-duty vehicles and any changes to the Inspection/Maintenance (I/M) requirements that may result so as not to impose any undue burden on states that are implementing I/M programs. **(Wisconsin Department of Transportation (IV-D-17))**

RESPONSE: We did not propose, and this final rule does contain, any changes to the Inspection/Maintenance (I/M) requirements for any state or locality. The OBD requirements, as finalized, do not create any additional burden on states. However, the codification of OBD system requirements allows for potential inclusion of heavy-duty vehicles and engines in I/M programs via a simple check of the OBD system.

Issue 20.8: General Support for On-board Diagnostics

COMMENT A: A number of commenters expressed support for the proposed OBD provisions. **(Manufacturers of Emission Controls Association (IV-D-38), Sierra Club (IV-D-15), Massuchusetts Department of Environmental Protection (IV-D-12), American Lung Association (IV-D-19), Wisconsin Department of Natural Resources (IV-D-20), Broadlink Communications (IV-D-45), Coalition for Clean Air (IV-D-53), Linda Lewis (IV-D-56), Missouri Department of Natural Resources (IV-D-63))** The American Trucking Association stated that OBD systems are "a way to improve the maintenance and performance of [the emissions control system] and to assure maximum operating efficiency." **(American Trucking Association (IV-D-21))** The National Automobile Dealers Association supports an appropriate OBD system mandate for all heavy-duty vehicles, "given the tremendous potential OBD systems have to improve in-use emissions and operating efficiency." **(National Automobile Dealers Association (IV-D-31))**

RESPONSE: We agree with these comments.

ISSUE 21: DEFEAT DEVICE DEFINITION

COMMENT A: EMA commented that the proposed defeat device definition (DDD) is different from that which is in the HD consent decrees signed by a number of engine manufacturers. EMA commented that in the consent decrees, the DDD excluded an auxiliary emission control device (AECD) that reduce the effectiveness of the emission control system under conditions substantially included in the federal test procedure from being considered a defeat device (DD). EPA's proposed revision of the DDD would not exclude the NTE and MAELs control areas from consideration for a defeat device. EMA comments that this results in a greater area of operation where DDs can be considered than what was agreed to under the consent decrees. EMA commented that AECDs are needed within the NTE and MAEL control zones to protect the engine from damaging conditions. The revised definition must explicitly state that attempts to address potentially damaging conditions within the NTE and MAEL control zones will not be at risk of violating the prohibition of defeat devices. EMA commented that the proposed definition leaves considerable room for interpretation which puts manufacturers at risk. EMA commented that EPA is obligated to provide a definition that is clear, concise, and unambiguous to all, while the proposal only adds confusion and uncertainty. EMA commented that AECDs are needed to supplement the primary emission control system when that strategy is unable to operate. EPA's failure to allow use of AECDs within the NTE and MAEL control zones increases stringency of the NTE and MAEL standards beyond that in the consent decrees. EMA commented that manufacturers not involved in the consent decrees have not received consistent information from EPA concerning the Agency's current or future enforcement intent with respect to the definition of defeat device or the acceptable use of AECDs. EMA recommends that instead of revising the existing definition, EPA should provide clear and concise AECD guidance in the context of the existing definition and specifically address issues such as overheat protection, altitude operation, transient operation with EGR, and control of trade-offs between emission constituents.

Detroit Diesel Corporation (DDC) commented that they accept EPA's purpose and the desire to prevent the general use of AECDs throughout the broad range of operation that could occur in NTE testing. However, DDC believes the proposed definition is unclear and confusing, and has the potential to be interpreted too broadly. DDC provided examples to clarify this point; for example, an emission control system which compensates for changing ambient conditions to maintain a constant emissions level would be considered a DD because under some conditions it would reduce the effectiveness of the emission control system. DDC provided a second example; an AECD which increased one pollutant slightly in order to produce a large decrease in a second pollutant could be considered a DD under the proposal. DDC comments that they do not believe EPA intended to prevent such control strategies, or to drastically limit calibration flexibility. DDC recommends that either the DDD be modified, or an additional guidance document be issued indicating the use of such control strategies is acceptable. DDC comments that modern electronic engine control systems are extremely complex and powerful. Manufacturers require clear guidance regarding the control strategies which are permitted and those which are not. DDC also commented on the proposed regulatory language that the prohibition of defeat devices (proposed §86.000-16(b)) does not specify who may be required to perform testing, and the language does not define "normal operation and use". DDC comments that it is not clear whether normal means typical operating conditions or any set of conditions that could be encountered in customer use. DDC comments that the types of tests to be run are not specified, and it is unreasonable to require manufacturers (or others) to perform tests for which equipment and procedures have not been developed. DDC comments that the intent of the proposed §86.000-16(d)(1) is unclear because the FTP

specifies conditions that are more limited than the universe of conditions that could be considered to be “encountered in normal operation and use.” DDC comments that this sub-paragraph implies that engines can not incorporate features which reduce the effectiveness of the emission control system even during the existing transient FTP, which DDC believes is contrary to reason and or their understanding of the Agency’s intent.

Navistar commented that the proposed change to the DDD increases the stringency of the proposed standards. Navistar comments that the existing DDD provides that an AECD which reduces the effectiveness of the emission control system will not be considered a DD if such conditions are substantially included within the FTP. Navistar commented the proposed change to the DDD, NTE and MAEL would not be included in the FTP exclusion, which means an AECD which operates within the NTE or the MAEL could be considered a DD. Navistar commented that this change could convert virtually all AECDs into defeat devices. As an example Navistar points to the use of EGR, which when used reduces NOx but can increase PM, because PM increases with the use of EGR, the EGR system could be deemed a DD. Without the use of EGR, the standards are more stringent.

Caterpillar Inc. commented that the proposed DDD is ambiguous and does not give the regulated community fair notice of the requirements to which they are subject. The proposal leaves open the possibility that a particular control strategy could be interpreted by EPA enforcement personnel to “unnecessarily reduce emission control effectiveness”, even if emissions never exceed the regulatory standard. This ambiguity is particularly troublesome in the context of electronic controls.

During a meeting with EPA after the close of the comment period, the Engine Manufacturers Association described a number of examples of emission and/or engine control strategies which they believed could be interpreted as defeat devices under the proposed defeat device definition in the NPRM. . The examples presented were;

1) Transition from Transient to Steady State Operation.

   An engine arrives at a specific speed and load point within the NTE control zone from some other point, and the engine stays at the new operating point for some period of time. The engine control system modulates EGR, injection timing, injection pressure, turbocharger boost, and/or other engine systems to maintain emissions within the proposed steady-state area control surface limits. In EMA’s view, the proposed change to the defeat device definition would provide the manufacturers little guidance on whether such a control strategy would be considered a defeat device.

2) Smoke Control during Transient Operation.

   During very transient engine operation within the NTE control zone, in order to control particulate matter emissions within acceptable customer limits, control strategies may be employed which results in increased NOx emissions (such as restricting or stopping EGR flow), though the proposed NTE NOx and PM limits would be met. In EMA’s view, the proposed change to the defeat device definition

makes it unclear whether such a control strategies be considered acceptable or a defeat device.

3) Engine Modulation to Keep NOx and PM NTE Compliant.

During engine operation under varying ambient temperature and/or altitude, an engine control strategy is employed which alters engine sub-system performance (for example, EGR rate, EGR temperature, turbocharger boost, fuel injection pressure, and/or fuel injection timing) to maintain emissions of PM and NOx within their respective proposed NTE limits, but the magnitude of one or both pollutants may increase due to the engine control strategies (but all emissions meet NTE requirements). In EMA's view, under a strict interpretation of the proposed defeat device definition, the engine control system would be considered to have a defeat device because the strategy reduced the effectiveness of the emission control system (PM and/or NOx increased).

4) Sulfate Generation.

A diesel oxidation catalysts (DOC) is employed as an emission control device. The use of the DOC provides PM reduction sufficient to meet the FTP emission limit; however, the DOC's PM reduction efficiency is not constant across the NTE control zone. A principle factor is that during certain operating conditions, those that result in higher exhaust temperature, aftertreatment devices convert a larger percentage of the fuel sulfur to PM sulfates. This in turn could result in exceedance of NTE requirements. In EMA's view, the defeat device definition in the NPRM makes it unclear whether the use of an aftertreatment device, by itself, could be considered a defeat device.

5) Engine Protection Strategy Contained within Steady-state Control Area (SSS) or NTE.

An engine protection strategy is used during operation within the NTE control zone, and the strategy results in an increase in one or more pollutants, but all pollutants meet the proposed NTE limits. In EMA's view, it is unclear whether or not such an engine protection strategy is allowed under the proposed definition of defeat device.

(EMA (IV-D-05), DDC (IV-D-28), Navistar (IV-D-29), Caterpillar Incorporated (IV-D-37)). See EPA memorandum to Docket A-98-32 "Meeting between U.S. EPA, California Air Resources Board, and the Engine Manufacturers Association to Discuss Heavy-duty 2004 Rule Issues on April 6 and 7, 2000."

RESPONSE: EPA has decided not to revise the defeat device definition in the manner indicated in the proposal.

In this final rule we have decided to retain the existing definition of defeat device contained in §86.094-2, with only a minor change to clarify that the applicable heavy-duty diesel federal emission test procedure includes the supplemental steady-state and not-to-exceed test procedures

beginning in model year 2007. We have also clarified the regulatory provisions regarding the prohibition of defeat devices by removing the word “unnecessarily” from the phrase “unnecessarily reduce emission control effectiveness”, and added the phrase “unless one of the specific exceptions set forth in the definition of ‘defeat device’ in § 86.004-2 is met.”

As with the current definition of a defeat device, use of a control strategy during conditions which are substantially included in the existing FTP, the supplemental steady state test, or the not-to-exceed test, would not be considered a defeat device, even where it otherwise would be considered to reduce the effectiveness of the emissions control system during such operation. For example, use of such an AECD during the appropriate FTP, steady state supplemental, or NTE test procedure is not a violation of the defeat device prohibition. However, the engine still must comply with the applicable emission standards. For example, operation of the AECD within the NTE control zone during operation which is applicable to the NTE standard must never cause the engine to exceed 1.25 times any applicable existing FTP standard, except where EPA has approved a manufacturers request for an NTE deficiency under 40 CFR 86.007-11(a)(4)(iv). The fact that operation of the AECD during such condition is not a violation of the defeat device prohibition does not change the obligation to also comply with the applicable emissions standard. The two obligations are separate and distinct, and both must be met. An engine may not have a defeat device and it also must comply with the applicable emissions standards. When an AECD operates under conditions which are not substantially included in the existing FTP, steady state supplemental test, or the NTE test procedure, then the AECD will be considered a defeat device if it reduces the effectiveness of the emissions control system under operations which could reasonably be expected to occur in normal vehicle operation and use, unless it meets one of the other exceptions to the defeat device definition (such as engine start up). EPA will continue to interpret this provision as it has in the past, focusing on changes to the emissions control system that cause emissions to increase above what they would be without the change.

The Agency recognizes that emission control strategies which are employed during the existing FTP and the supplemental test procedures (NTE and supplemental steady state) require the manufacturer to control a complex system of engine hardware. This includes the modulation of engine sub-systems (e.g., EGR temperature, EGR flow rate, turbocharger boost, fuel injection timing and pressure) to maintain emissions performance and also achieve engine performance, with the potential to increase or decrease NOx, PM and/or other regulated pollutants while keeping all pollutants at or below all applicable emission standards. The Agency’s prohibition of the use of defeat devices will continue to protect against the use of illegal emission control strategies, including but not limited to timers or “cycle sensors”, whose purpose or result is to reduce the effectiveness of the emission control system during conditions which are not substantially included in the applicable federal emission test procedures, and do not meet the other exemptions in the defeat device definition. Strategies that “reduce effectiveness” of the emission control system would include those that change the way the emission control system operates during off-cycle conditions and increase emissions from the engine above what they would be without the change. For example, if a manufacturer operates an EGR system during on-cycle conditions in order to comply with applicable emission standards, it must operate the EGR system in a similar manner during off-cycle conditions, unless, for one of the allowable reasons set forth in the definition of defeat device, it cannot do so.

Moreover, while the definition of defeat device allows as exception strategies needed to protect the engine against accident or damage, EPA intends to continue its policy of closely

reviewing the use of this exception. In determining whether a reduction in emissions control effectiveness is "needed" for engine protection, EPA would closely evaluate the actual technology employed on the engine family, as well as the use and availability of other emission control technologies across the industry, taking into consideration how widespread the use is, including its use in similar applications.

For example, as discussed throughout this final rule, in the context of the HD diesel 2004 standards we expect to see wide-spread use across all HD applications of advanced electronic fuel injection systems (such as common-rail or second generation unit injectors), advanced turbocharging systems (such as VGT systems), and cooled EGR systems. If, for example, a manufacturer uses hot EGR instead of cooled EGR, and seeks approval to reduce the emissions control system effectiveness to protect against engine damage during operation not substantially included in the FTP, EPA will closely review the request and intends among other things to evaluate the feasibility of cooled EGR in determining whether the reduction in emissions control effectiveness is in fact "needed" and appropriate. Under appropriate circumstances, EPA might determine that a reduction in emissions control effectiveness was not needed to protect the engine, based on a choice of a certain technology in the context of the widespread use in similar application of a different technology without the same need for protection.

Manufacturers must continue to comply with the existing certification requirement to fully disclose and describe all AECDs in their certification applications. The Agency will continue to review all AECDs, in particular those which impact emission performance during conditions not substantially included in testing under the applicable federal emission test procedures, including beginning in model year 2007, the supplemental steady-state and not-to-exceed test procedures.

EMA commented that AECDs may be needed during NTE engine operation in order to protect the engine or vehicle from damaging conditions. Several commenters provided examples of emission control strategies which would be used during operation substantially included in the NTE requirements which result in one pollutant increases while another decreases. This final rule allows manufacturers to utilize AECDs during NTE operation. Of course, as discussed above the engine must meet the NTE standard. The provision of the existing definition of defeat device which allows an AECD to increase emissions under conditions not substantially included in the applicable test procedures if the AECD is justified in terms of protecting the vehicle against damage or accident has been left unchanged.

The definition of DD contained in this final rule clarifies that in the future the provisions of the existing DDD which states that conditions substantially included in the FTP will also include conditions substantially included in the NTE, SSS and MAEL in model year 2007 for HDDE.

The regulatory language on the prohibition of defeat devices which DDC commented on in §86.000-16, are existing regulatory provisions, which manufacturers have been subject to for a number of years. DDC commented that §86.000-16 does not specify who may be required to perform testing to demonstrate that an AECD is not a defeat device. This provision could be used by the Agency to require additional testing of an engine for which the manufacturer has requested or received a certificate of conformity in order to demonstrate that an AECD which the manufacturer has disclosed is not a defeat device. In addition, the Agency also has the right to perform emissions testing of an engine at an EPA facility or an EPA contractor facility in order to assess whether or not an AECD is a defeat device. Regarding performance of tests for which equipment

and procedures have not been developed, see discussion in Issue 8.6. DDC commented that normal operation and use is not defined in §86.000-16(b). This is existing regulatory language and we did not make any change to this existing regulatory provision. See Issue 8.6 for a further discussion of the term "normal operation and use." DDC also commented on §86.000-16(d)(1), which is also an existing regulatory provision. Existing EPA provisions regarding the prohibition of defeat devices require that manufacturers disclose AECDs to EPA, and it requires that engine manufacturers understand how these AECDs effect the emissions performance of the engine during conditions which may reasonable be expected to be encountered in normal operation and use. This provision refers to conditions which are not included during the FTP, and is not a restriction on the use of AECDs during the FTP.

As finalized in this rule, the DDD and the prohibition of defeat devices do provide the regulated community fair notice of the requirements which they must meet. As discussed above, this final rule clarifies that if an AECD reduces the effectiveness during conditions which are substantially included in the FTP, the NTE, the SSS, and/or the MAEL, the AECD is not a defeat device, with respect to it's operation during the FTP, the NTE, the SSS and/or the MAEL.

Regarding the five examples provided by EMA. To the extent the example AECD's are operating during conditions which are substantially included in the NTE, the AECD's discussed in example 1, 2, 3, and 5 would not be considered defeat devices. Regarding example 4, a diesel oxidation catalysts (DOC) would not be a defeat device because it is not an AECD. An AECD *"means any element of design that senses temperature, vehicle speed, engine rpm, transmission gear, manifold vacuum, or any other parameter for the purposes of activating, deactivating, or modulating the operation of any part of the emission control system"* (See 40 CFR 86.082-2). A DOC is a completely passive device and does not sense any engine or vehicle parameter. However, as described by EMA, example 4 may not meet the NTE emission standard, and therefore may not be a certifiable engine family if it does not meet an applicable emission standard (in this case the NTE).

ISSUE 22: NONCONFORMANCE PENALTIES

BACKGROUND: Section 206(g) of the Clean Air Act (the Act), 42 U.S.C. 7525(g), requires EPA to issue a certificate of conformity for HDEs which exceed an applicable section 202(a) emissions standard, but do not exceed an upper limit associated with that standard, if the manufacturer pays a nonconformance penalty (NCP) established by rulemaking. Congress adopted section 206(g) in the Clean Air Act Amendments of 1977 as a response to perceived problems with technology forcing heavy-duty emissions standards. If strict standards were maintained, then some manufacturers, "technological laggards," might be unable to comply initially and would be forced out of the marketplace. NCPs were intended to remedy this potential problem. The laggards would have a temporary alternative that would permit them to sell their engines or vehicles by payment of a penalty. There are three criteria for determining the eligibility of emission standards for nonconformance penalties in any given model year. First, the emission standard in question must become more difficult to meet. Second, substantial work must be required to meet the emission standard. We consider "substantial work" to mean the application of technology not previously used in that vehicle or engine class/ subclass, or a significant modification of existing technology, to bring that vehicle/engine into compliance. We do not consider minor modifications or calibration changes to be classified as substantial work. Third, a technological laggard must be likely to develop. A technological laggard is defined as a manufacturer who cannot meet a particular emission standard due to technological (not economic) difficulties and who, in the absence of NCPs, might be forced from the marketplace. In our proposal, we agreed that the first and second criteria have been met, but we were not convinced that a technological laggard is likely to develop.

COMMENT A: EMA, Mack, DDC and Navistar commented that EPA should establish NCPs as soon as possible. They argued that a technological laggard is likely to develop, and that NCPs will be necessary for the 2004 model year. This argument was based partially on the proposal to apply the supplemental test requirements in 2004. **(EMA (IV-D-05), Mack (IV-D-06), DDC (IV-D-28), Navistar (IV-D-29))**

RESPONSE: We believe that it is too early to conclude that a technological laggard is likely to develop. However, EPA believes it appropriate to continually monitor the status of technology development for these standards, and intends to establish appropriate NCPs for them in a timely fashion should the criteria for NCP availability be met. We dispute the manufacturers' claim that NCPs must be made available well in advance of the applicable date of the standards they are intended for. The implication is that NCPs should be considered just another compliance tool, similar to the averaging, banking and trading program. We believe that the purpose of NCPs is to assure that a manufacturer can continue selling its product even if its development efforts toward compliance with the standards falls short despite its best efforts at achieving compliance. Previous experience with NCPs indicates that they can be put into place within two years once it has become apparent that they are necessary (see 61 FR 6949, February 23, 1996, that established NCPs for the 1998 HDE NOx standard). Thus, we do not believe that it will be necessary to make a determination regarding the likelihood of a technological laggard until the end of this year, since that would still allow us enough time to finalize NCPs prior to the start of the 2004 model year if they are needed. For those requirements not taking effect until model year 2005 or 2007 there is even more time to make a decision.

ISSUE 23: ECM DATA REQUIREMENTS

BACKGROUND: We proposed regulations under which manufacturers would be required to provide to us information that we request to read and interpret emission control information broadcast by an engine's electronic control module. The proposed regulatory language is:

Upon request from EPA, a manufacturer must provide to EPA hardware (including scan tools), passwords, and/or documentation necessary for EPA to read and interpret (in engineering units if applicable) any information broadcast by an engine's on-board computers and electronic control modules which relates in anyway to emission control devices and auxiliary emission control devices. Passwords include any information necessary to enable generic scan tools or personal computers access to proprietary emission related information broadcast by an engine's on-board computer, if such passwords exist. This requirement includes access by EPA to any proprietary code information which may be broadcast by an engine's on-board computer and electronic control modules. Information which is confidential business information must be marked as such. Engineering units refers to the ability to read and interpret information in commonly understood engineering units, for example, engine speed in revolutions per minute or per second, injection timing parameters such as start of injection in degree's before top-dead center, fueling rates in cubic centimeters per stroke, vehicle speed in miles per hour or kilometers per hour.

COMMENT A: NESCAUM, STAPPA/ALAPCO, and the Wasatch Clean Air Coalition all supported this requirement as necessary to ensure in-use compliance. STAPPA/ALAPCO stated that it's support was "based on the experience involving the use by some manufacturers of defeat devices on heavy-duty vehicles." EMA opposed this requirement. They argued that it is unnecessary because of the proposed not-to-exceed standards, that cover a broad range of in-use conditions. They also stated that this requirement would be excessively burdensome because the manufacturer would not normally have this information readily available. They also objected to being required to provide EPA with a commercially available scantool, and that EPA should be expected to purchase such tools. **(EMA (IV-D-05), NESCAUM (IV-D-26), STAPPA/ALAPCO (IV-D-32), Wasatch Clean Air Coalition (IV-D-40))**

RESPONSE: We agree with the commenters who believe this requirement is necessary to ensure in-use compliance. Modern HD engines make extensive use of on-board computers for fuel system control, and other emission-related component control, which will likely include the EGR systems. Many of these newer systems make use of Controller Area Networks as a means of communicating information from the ECM to other on-board sensors and control devices (such as fuel injectors, rail pressure for common rail systems, boost-pressure sensors, coolant level sensors, coolant temperature sensors). These on-board systems control many aspects of emission related components, including fuel and air management components. We need to make sure that electronic controls (or any other Auxiliary Emission Control Devices) are not used in such any way that would result in higher emissions from HD engines in use than would be seen during certification or laboratory testing. Therefore, we must have access to this information. The not-to-exceed standards are not sufficient by themselves to ensure in-use compliance. Electronic controls have become so sophisticated that it is unlikely that any in-use test could account for all of the possible permutations of variable engine parameters. Moreover, in some cases it is not even possible to perform the test without some of this information. Thus, we continue to believe that this requirement is necessary. While we do not believe that this requirement is inherently burdensome, we understand EMA's concern regarding the potential burden. Most of the information that will be

required should be readily available. In some cases manufacturers may need to put some additional effort into documenting their electronic controls. However, EMA provided no constructive comments that would help us to reduce this burden. It should be noted that this requirement does not mean that manufacturers will need to submit all of this information with each application for certification. We intend to require this information only to the extent that is necessary.

With respect to the need to require manufacturers to provide EPA with a commercially available scantools. In the final regulations, manufacturers will only be required to provide to EPA those tools that are not commercially available. However, this will not restrict our broader authority to require manufacturers to provide any necessary information under Section 208 of the Act.

ISSUE 24: CERT APPLICATION REQUIREMENTS

COMMENT A: EPA should review proposed section 86.004-21 of the regulations and eliminate any requirements that are not absolutely essential to legitimate certification review and enforcement needs. Assembling the information to meet the proposed requirements will be extremely burdensome, particularly with respect to the generation of data to support the required compliance statements. **(Detroit Diesel Corporation (IV-D-28))**

RESPONSE: We have reviewed the regulatory requirements in the context of the comments and the changes to the certification and compliance program in the final rule. We believe that the data submittal requirements as they are finalized are necessary elements of the certification program and that they do not create a significant additional burden. The new information that manufacturers are required to submit under the regulations generally relate either to the specifics of the steady-state test (emission results and related information) or to the manufacturer's information that supports the compliance statements that they must make at certification.

COMMENT B: Because there is an infinite number of possible operating modes and ambient conditions, it is uncertain if manufacturers could ever generate sufficient data to provide assurance that MAEL and NTE requirements will be met under every conceivable combination of operating conditions. **(Engine Manufacturers Association (IV-D-05), Detroit Diesel Corporation (IV-D-28))** EPA should provide guidance on how to demonstrate compliance with the NTE and MAEL requirements. **(Detroit Diesel Corporation (IV-D-28))**

RESPONSE: The commenters are correct that the regulations require compliance over a broad range of operating conditions. However, the boundaries of conditions under which compliance is required are defined. The speed and torque must fall in a specific area, and the the ambient temperature and altitude are limited as well. Within these certain boundaries compliance with the emission standards is required. Our response to the issue of an unlimited number of operating conditions and ambient conditions, and why the commenters' issue is not supported by fact, is detailed under Issue 8.6. Regarding how to demonstrate compliance with these requirements, we believe that sufficient guidance is provided in the final rule. See Issue 8.

COMMENT C: EPA must be able to ensure that all information submitted with a claim of confidentiality is handled appropriately. **(Detroit Diesel Corporation (IV-D-28))**

RESPONSE: We are able to ensure appropriate handling of confidential business information (CBI). We receive CBI from manufacturers on a regular basis as part of the EPA certification and compliance programs. Specific protocols are in place, guided by regulation, regarding the handling of CBI. Our facility and our employees are well-equipped and well-informed with regard to how to handle and store CBI.

ISSUE 25: DUE PROCESS, NOTICE AND COMMENT, AND OTHER LEGAL ISSUES

Issue 25.1 Due Process and Notice and Comment Issues

COMMENT A: EPA failed to provide stakeholders with adequate due process because the NPRM was published in the Federal Register on October 29, 1999, and the public hearing occurred several days later on November 2, 1999. EPA did not provide adequate notice of the public hearing. **(Engine Manufacturers Association (IV-D-05))**

RESPONSE: We made the notice of proposed rulemaking available on the EPA web site on October 6, 1999 and notified key interested parties, including the Engine Manufacturers Association, with personal phone calls that the text of the proposal was available. We provided further notice of the public hearing by publishing a notice of the public hearing in the Federal Register on October 22, 1999 (64 FR 56985), which referenced the availability of the notice of proposed rulemaking on EPA's web site. Consequently, despite the fact that actual publication of the proposed rule occurred on October 29, 1999, the commenter experienced no loss of due process because they were able to begin their review of the proposal starting 28 days prior to the public hearing.

COMMENT B: EPA's timetable for the rulemaking prevents complete and fair consideration of key issues. The timetable forces a rapid review of public comments and a rushing of the final decision making process. **(American Trucking Association (IV-D-21))** Serious issues have been raised about EPA's rush to finalize a rule by the end of 1999. **(National Automobile Dealers Association (IV-D-31))** Rushing to finalize this rule to meet an arbitrary deadline would be an abuse of the Agency's regulatory authority. **(DaimlerChrysler (IV-D-44))** EPA is rushing the rulemaking process by attempting to complete the final rule by the end of 1999. **(Rep. David M. McIntosh, U.S. House of Representatives (IV-D-54))** EPA does not appear to have allocated sufficient time to fully consider the comments. Completion of the rulemaking by the end of 1999 is not practical. **(Ford Motor Company (IV-D-08), General Motors Corporation (IV-D-65))** EPA's rushed schedule to review and analyze comments, determine changes to the rule, and publish the final rule by December 31, 1999 does not give justice to such an important and far-reaching rule.

RESPONSE: It should be clear by now that EPA found it impractical to finalize the rule by the end of 1999, although this target was never considered arbitrary and would not have constituted an abuse of regulatory authority. However, because finalization of the rulemaking has been extended to mid-2000, these comments are now moot.

COMMENT C: EPA's proposal shortchanges the opportunity for meaningful comment on the proposed requirements. EPA has failed to provide interested parties due process of law to review, analyze, and provide meaningful comment to EPA on the proposal. **(Engine Manufacturers Association (IV-D-05))** EPA did not provide sufficient time for comment on the proposal. **(Ford Motor Company (IV-D-08), DaimlerChrysler Corporation (IV-D-44), General Motors Corporation (IV-D-65), automotive aftermarket trade associations (IV-D-75))** EPA failed to provide due public process including adequate notice and opportunity for public comment for actions that effectively change an emission standard. The trucking industry was denied a fair opportunity to provide comment on any proposed changes in emission standards. **(American Trucking Association (IV-D-21))** Given the magnitude, importance, and complexity of the proposed rule, the 57 day public comment period allowed by EPA is inadequate. **(Detroit Diesel Corporation (IV-D-**

28)) The rushed nature of the rulemaking does not provide adequate opportunity for public participation per the public notice and comment period provisions of the Administrative Procedures Act. **(DaimlerChrysler (IV-D-44))** One public hearing and 30 days for public comment are inadequate to give the public and the regulated community an effective opportunity to participate in the regulatory process. The comment period, as extended, amounted to 44 days, an insufficient amount. EPA did not comply with Executive Order 12866, which states that "each agency should afford the public a meaningful opportunity to comment on any proposed regulation, which in most cases should include a comment period of not less than sixty days," or Executive Order 12044 in which President Carter established 60 days as the minimum length of comment periods for all significant rules. The comment period should be extended to a minimum of 60 days, and preferably to 90 days. **(Rep. David M. McIntosh, U.S. House of Representatives (IV-D-54))** Establishment of an unduly short period of time to comment is arbitrary and capricious, and requires remand to the agency for consideration of evidence that could not be prepared in time to satisfy the agency's deadline. Extending the comment period to December 16 still provided an insufficient comment period. **(General Motors Corporation (IV-D-65))**

RESPONSE: As noted above, the proposed rule was made available on the EPA web site on October 6, allowing up to 27 days prior to the public hearing for review. The initial comment period allowed an additional 30 days following the public hearing, which was subsequently extended by two weeks. The result is that the commenters were given a total of up to 71 days, or almost two-and-a-half months, to review the rule and provide comments to the Agency. We believe that this is an adequate amount of time, and is consistent with the requirements of the Act and Executive Order 12866. Executive Order 12044 was revoked by Executive Order 12291 on February 17, 1981. In addition, EPA has met on numerous occasions with interested parties, including many of the commenters, following the end of the comment period, as indicated in the record. EPA had also met with manufacturers prior to the proposal and provided information to them regarding the contents of the proposal.

COMMENT D: EPA has failed to provide due process of law under the Clean Air Act by failing to provide details or justification for many of the proposed requirements and programs. EPA failed to provide an explanation of the bases for many of the proposed actions or sufficient details of those proposals. **(Engine Manufacturers Association (IV-D-05))** EPA must release to the public the basis for the proposed rule and provide an opportunity for full and meaningful comment by all interested parties. **(DaimlerChrysler (IV-D-44))**

RESPONSE: The proposed rule and the final rule present details and justification for the programs in the rulemaking, although the commenters may not agree with them. Lack of agreement with these bases does not mean that the Agency failed to present them. The bases for these requirements were thoroughly explained in the proposed rule, and further detailed in this final rule. Both the proposed and final rules detail the requirements being finalized and refer to numerous items in the public docket that support the proposed and final rules.

COMMENT E: The proposed test procedures are impermissibly subjective and thus fail to provide "fair notice" of whether the Agency will consider a manufacturer to be in compliance. Test procedures that could take place under any normal operating conditions, combined with a 30-second interval, in conjunction with a not-to-exceed approach, would create wide variability in testing results, would not simulate real-world conditions, and would be both impracticable an unpredictable. Under applicable legal standards such testing is unlawful. **(General Motors Corporation (IV-D-**

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RESPONSE: As explained under Issue 8, we disagree with the commenter that the test procedures lack objectivity. Moreover, the standards and procedures are bound by specific numerical limitations and are described clearly. Consequently, the "applicable legal standards" to which the commenter refers should confirm the legality of finalizing these standards.

Issue 25.2 Proposal does not Comply with Clean Air Act

COMMENT A: Proposed standards and test procedures are impractical, cost-ineffective, and potentially harmful to the environment, and are therefore contrary to the Clean Air Act. Attempting to eliminate isolated exceedances through a not-to-exceed cap would be cost-ineffective to the pont of being counterproductive, and therefore would be contrary to law. **(General Motors Corporation (IV-D-65))**

RESPONSE: The Regulatory Impact Analysis for this final rule details the costs, benefits, and cost-effectiveness of the provisions being finalized. Issue 6 in this document summarizes and assesses comments regarding the cost-effectiveness of the proposed provisions. Issue 8 discusses cost implications of the supplemental requirements. This document, the Regulatory Impact Analysis, and the preamble to the final rule thoroughly explain how the finalized provisions are cost-effective and how the environment benefits from significant reductions in emissions from heavy-duty engines.

COMMENT B: Because EPA did not explain why the proposal departs from the Statement of Principles, or why the proposed test procedures depart from past practice, the proposal is not consistent with the reasoned decision making requirements of Clean Air Act § 307(d)(9) and 5 U.S.C. § 706. EPA's claim that the proposed test procedures "more closely represent the range of real world driving conditions" is inaccurate and does not provide a reasoned basis for departing from past practice. The proposed test procedures are not easily implementable and therefore are contrary to law and inconsistent with the reasoned decisionmaking requirements of section 307(d)(9) of the Clean Air Act. EPA has not explained how the not-to-exceed standards are achievable under the range of relevant conditions which may affect emissions, therefore the not-to-exceed standard is inconsistent with the statute and reasoned decisionmaking. Because the proposed steady-state test is not correlated with the FTP there is no way to determine feasibility or stringency of the steady-state test; proceeding without this information is inconsistent with the decisionmaking requirements of section 307(d)(9) of the Clean Air Act. Requiring compliance with the steady-state test, which increases costs, decreases engine efficiency, and results in the use of larger engines is inconsistent with the decisionmaking requirements of section 307(d)(9) of the Clean Air Act. It is inconsistent with reasoned decisionmaking requirements to promulgate a requirement to test engines in a manner that is not correlated with air quality and which could actually make emission reductions more difficult. **(General Motors Corporation (IV-D-65))**

RESPONSE: Issue 8.2 explains why the Statement of Principles (SOP) is not, and can not be, a document that binds the Agency regarding the outcome of a rulemaking process. The reasons why EPA has revised its prior regulations (as well as departing from the SOP), are thoroughly explained in the proposed and final rules. The commenter has not demonstrated a violation of section 307(d)(9) of the Clean Air Act for these reasons. The numerous other reasons cited by the commenter as to why the rule is counter to the reasoned decision making requirements of the Clean Air Act are considered throughout this document. The test procedure comments are addressed

under Issue 8, the Load Response Test comments are addressed under Issue 10, and the air quality comments are addressed under Issue 2. EPA has given reasoned explanations for all its regulatory revisions in this document, as well as the preamble, Regulatory Impact Analysis, and other supporting documents, for this rule. We disagree with each of the commenter's arguments for why the rule is inconsistent with the reasoned decision making requirements of the Clean Air Act.

Issue 25.3 Proposal is Arbitrary & Capricious

COMMENT A: The propose rule is arbitrary and capricious, an abuse of discretion and otherwise not in accordance with applicable law. EPA has articulated no rational nexus between the proposed actions to be taken, and the burdens, feasibility, cost and related factors that the Act requires EPA to consider in fashioning its proposed actions. EPA must address the concerns raised by industry during the comment period and provide a rational basis for any final rule which results. **(Engine Manufacturers Association (IV-D-05))**

RESPONSE: We disagree with the commenter's contention that the rule is arbitrary, capricious, an abuse of discretion, and not in accordance with law. Both the proposed and final rules contain considerable discussions regarding the feasibility, cost, emission reductions, and cost-effectiveness of the proposed and finalized provisions. These discussions document the need for the finalized provisions and the fact that they are feasible and cost-effective.

COMMENT B: EPA's rule is arbitrary and capricious and an abuse of the Agency's discretion in the rulemaking process because non consent decree companies were not given an opportunity to participate in the overall development of the proposal. **(DaimlerChrysler (IV-D-44))**

RESPONSE: EPA disagrees with the comment. Non-consent decree companies as well as consent decree companies participated in numerous meetings with the Agency prior to the issuance of the proposal, and were offered just as many opportunities to participate as those involved in consent decrees. Information regarding the specifics of the rulemaking that was shared with the industry was shared with all manufacturers at the same time, regardless of their consent decree status. Non-consent decree manufacturers have had the same opportunity to comment on the proposed rule as other parties.

Issue 25.4 EPA Should Consider Other Sources of Emissions

COMMENT A: EPA must consider the equity of emissions reductions from all sources, including off-road and stationary sources. Off-road engines should be contributing an equitable share toward attaining national air quality goals, and shouldering a fair portion of the costs and responsibility to improve national air quality. **(American Trucking Association (IV-D-21))** It is inequitable to lower emission standards for on-road sources when non-road and stationary sources account for the vast majority of all NOx and VOC emissions. On-road sources should not be held disproportionately responsible for NAAQS attainment. EPA's emission standards should reflect the corresponding responsibility of the major offenders. **(Rep. David M. McIntosh, U.S. House of Representatives (IV-D-54))**

RESPONSE: We understand the concern of these commenters. However, regardless of any potential need or desire to address emissions from other sources, our proposed and final rule clearly articulates the need for and cost-effectiveness of achieving emission reductions from on-highway

heavy-duty engines, and is consistent with the Clean Air Act's requirements regarding such engines. Emissions from other sources have been addressed in the past and will be addressed in future rulemaking efforts by the Agency, as appropriate, but these sources were not addressed in our proposal and are not addressed in the final rule.

ISSUE 26: MEDIUM DUTY PASSENGER VEHICLES

In December of 1999 we finalized a major, comprehensive program designed to reduce emission standards for passenger cars, light trucks, and large passenger vehicles (including sport-utility vehicles, minivans, vans, and pickup trucks) and to reduce the sulfur content of gasoline. Under the program, automakers will produce vehicles designed to have very low emissions when operated on low-sulfur gasoline, and oil refiners will provide that much cleaner gasoline nationwide. This comprehensive program is referred to in this preamble as the "Tier 2/Gasoline Sulfur program," or simply the "Tier 2 program."

The proposal for the Tier 2/Gasoline Sulfur program (64 FR 26004, May 13, 1999) raised specific issues relating to vehicles over 8,500 pounds GVWR, and thus classified as heavy-duty vehicles. We requested comment in the Tier 2 NPRM on several potential options that would have applied more stringent standards to vehicles over 8,500 pounds GVWR, including the possibility of extending the GVWR limits that define light-duty trucks. Specifically, we requested comment in the Tier 2 NPRM on, among other options, requiring "all complete trucks in the 8,500 -10,000 pound GVWR range to meet light-duty standards "(64 FR 26089). The Tier 2 NPRM also stated that we would be "very likely" to finalize a provision to address vehicles over 8,500 pounds GVWR."

In the NPRM for this heavy-duty rule, we proposed to include all personal use passenger vehicles (both gasoline and diesel fueled) between 8,500 and 10,000 pounds GVWR in the Tier 2 program. This group of vehicles would include large SUVs and passenger vans and may include other types of "crossover" multipurpose vehicles in the future, depending on new vehicle designs.

We received in excess of sixty comments supporting the application of one set of emission standards to all passenger vehicles, including trucks and SUVs. Many of these commenters urged us to apply these standards uniformly to all passenger vehicles at the same time, without allowing large trucks and SUVs additional time to meet the standards. Some other commenters opposed bringing trucks and SUVs over 8500 pounds GVWR into the Tier 2 program. Many of these opposing commenters questioned the legality of the approach that we proposed to bring these vehicles into the Tier program.

Tier 2 standards for these passenger vehicles above 8,500 pounds GVWR were finalized in the Tier 2 final rule (65 FR 6698, February 10, 2000). These vehicles are included in the Tier 2 program beginning in 2004 and are required to meet the final Tier 2 standards in 2009 and later model years. To effect this, we created a new category of heavy-duty vehicles termed "medium-duty passenger vehicles" (MDPVs). We define medium-duty passenger vehicles as any complete heavy-duty vehicle less than 10,000 pounds GVWR designed primarily for the transportation of persons including conversion vans (i.e., vans which are intended to be converted to vans primarily intended for the transportation of persons).[35] We do not include any vehicle that (1) has a capacity of more than 12 persons total or, (2) that is designed to accommodate more than 9 persons in seating rearward of the driver's seat or, (3) has a cargo box (e.g., a pick-up box or bed) of six feet or more in interior length. MDPVs will generally be grouped with heavy light-duty trucks (HLDTs) in the Tier 2 program.

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[35] The conversion from cargo to passenger use usually includes the installation of rear seating, windows, carpet, and other amenities

Comments received in the public docket regarding MDPVs were addressed by the Tier 2 final rule, and will not be addressed in this document. For more information on the new medium-duty passenger vehicle category, including a summary and analysis of the public comments, see the Tier 2 final rule. (See 65 FR 6698, February 10, 2000.)

ISSUE 27: DEFERRED ISSUES (OBD/OTTO-NTE/IN-USE/RATED SPEED)

COMMENT A: Many commenters expressed a general support for EPA's discussion of a need to address several additional heavy-duty issues, either in this final rule or in a future rulemaking. Specifically support was expressed for; (1) on-board diagnostics for all HD vehicles, and (2) an in-use testing program by manufacturers for all HD engines and vehicles. Some of these commenters went on to state that a manufacturer run in-use testing program was important to ensure emission reductions are achieved throughout a vehicle's useful life. Two commenters (ALA, STAPPA/ALAPCO) were discouraged EPA did not propose requirements for OBD for all vehicles and a mandatory in-use testing program. Several commenters urged EPA to commit to addressing these issues in the final rule and to commit to a 2004 implementation date. One commenter (NESCAUM) was concerned that EPA's estimated emission benefits from the proposed standards are too great because of the lack of an in-use enforcement program, which should be addressed. One commenter expressed support regarding the extension of OBD to all HD engines (NADA). One commenter (Georgia DNR) supported the establishment of an in-use testing program. **(Sierra Club (IV-D-02), Sierra Club - PA Chapter (IV-D-15), Massachusetts Department of Environmental Protection (IV-D-12)**, **American Lung Association (IV-D-19), Wisconsin Department of Natural Resources (IV-D-20)**, **NESCAUM (IV-D-26), National Automobile Dealers Association (IV-D-31)**, **STAPPA/ALAPCO (IV-D-32), Clean Air Network (IV-D-34), BroadLink Communications (IV-D-45), Several Private Citizens (IV-D-46, IV-D-47, IV-D-56), Georgia Department of Natural Resources (IV-D-52), Coalition for Clean Air (IV-D-53), Environmental and Energy Study Institute (IV-D-77))**

RESPONSE: In general, we agree with the comment that some form of on-board diagnostics (OBD) is likely appropriate for all HD engines, including engines used in vehicles with a GVWR greater than 14,000 pounds. We also agree that a reasonable and robust in-use testing program by manufacturers would be an important component of an effective compliance program. However, we believe that there are still important issues to be reviewed prior to proposing such requirements. We did not propose OBD for >14,000 pound GVWR vehicles nor an in-use testing program for the HD engine manufacturers, and the final rule does not address these issues. However, we will consider these comments, gather additional information, and work with other interested parties to develop a proposal to address these important topics. We do not rule out the possibility of a 2004 implementation of programs which address these two issues. However, the Agency must go through a formal rulemaking process prior to implementing any regulatory requirement. Any future standards would be subject to the leadtime requirements in section 202(a)(3). Thus no guarantee can be made regarding a potential implementation date.

COMMENT B: Commenters supported the concept additional of in-use emission requirements for heavy-duty gasoline similar to the supplemental standards proposed for HD diesel which would ensure in-use compliance over a broad range of operating conditions. Two commenters urged the Agency to follow through on this issue with a proposal for supplemental standards for HD gasoline engines soon, and to finalize a requirement in time for a 2004 implementation. **(Massachusetts Department of Environmental Protection (IV-D-12), American Lung Association (IV-D-19)**, **NESCAUM (IV-D-26), STAPPA/ALAPCO (IV-D-32)**, **Environmental and Energy Study Institute (IV-D-77))**

RESPONSE: The final rule for today's action contains no supplemental standards or test requirements for HD Otto-cycle engines. We agree with the comments that a program may be needed to ensure HD Otto-cycle engines are meeting the appropriate standards over a broad range of in-use operating conditions. However, as explained in the NPRM, the Agency believes more information regarding HD Otto-cycle emission performance is needed, as well as additional information on the definition of an NTE zone which may be appropriate for HD Otto-cycle engines (64 FR 58515). We do not rule out the possibility of a 2004 implementation of a program which addresses this issues. However, the Agency must go through a formal rulemaking process prior to implementing any regulatory requirement. Thus no guarantee can be made regarding a potential implementation date.

COMMENT C: A number of commenters agreed with EPA's discussion in the proposal that EPA should defer to a future rulemaking the issues associated with (1) on-board diagnostics for HD vehicles >14,000 pounds GVWR, (2) in-use testing program by manufacturers for all HD, and (3) addressing issue of rated speed for HD engines. One commenter believed there were information gaps which warranted EPA's decision not to make a proposal at this time (DDC). These commenters did not necessarily agree that these issues require a regulatory solution. One commenter did not oppose a 2004 implementation of regulatory requirements which addressed these issues, provided sufficient time was provided to implement the changes (DDC). **(Engine Manufacturers Association (IV-D-05), Detroit Diesel Corporation (IV-D-28))**

RESPONSE: As stated in response to Comment A above, the Agency also believes more time would be useful to develop a formal proposal on these important issues. We intend to work with EMA, DDC, and all other interested parties in a future rulemaking development process to address these three issues.

COMMENT D: Two commenters agreed with EPA's discussion in the proposal that the definition of rated speed used during the certification of heavy-duty diesel engines needs to be revised. One commenter suggested a simple mathematical algorithm as an example (NY-DEC) of a revised definition they thought would be appropriate. **(NESCAUM (IV-D-26), New York State Department of Environmental Conservation (IV-D-41))**

RESPONSE: The NPRM contained a discussion of why the current definition of rated speed used during the certification test for HD diesel engines may need to be revised (64 FR 58514). We agree with these two comments, and we will consider the suggestion of the NY-DEC as we consider potential methods to resolve this issue.

COMMENT E: Based on the discussion regarding OBD in the proposal, one commenter believes that EPA's decision not to propose OBD requirements for HD engines used in vehicles >14,000 pounds GVWR was arbitrary, and they urged EPA to mandate OBD for all HD engines(STAPPA/ALAPCO). A second commenter saw no logical reason why EPA should not require OBD for all HD vehicles by 2004 (ICTA). **(STAPPA/ALAPCO (IV-D-32), International Center for Technology Assessment (IV-D-61))**

RESPONSE: We disagree with the comment that our decision not to propose OBD for HD engines used in vehicles >14,000 pounds GVWR was arbitrary. The proposal included two justifications for our decision not to propose OBD for this class of vehicles at this time: (1) heavy-use of power take-off units in this segment of the market which complicates many OBD monitoring systems, and (2)

lack of vertical integration in the >14,000 pound vehicle market (64 FR 58515). While these issues are surmountable, they will require additional time for the Agency to consider and develop solutions which would result in a reasonable proposal for OBD requirements for the >14,000 pound GVWR HD market, and thus justify our decision not to propose requirements at this time.

COMMENT F: EPA should require an in-use testing program administered and policed by EPA, not by the engine manufacturers. **(International Center for Technology Assessment (IV-D-61))**

RESPONSE: As discussed in response to Comments A, no manufacturer-based in-use testing program for HD engines was proposed, and the final rule does not contain any such in-use testing program. We will consider this comment during the development of a future in-use testing program.

COMMENT G: The proposed NTE limits are not feasible, unnecessary and cost-ineffective for Otto-cycle engines. NTE limits are not justified. NTE is an unsound approach. The NTE approach is not suited to gasoline engines with aftertreatment, and NTE does not recognize the importance of protection enrichment. These comments were supported by detailed technical and legal discussion in General Motors Corporations comments. EPA may not require manufacturers to conduct in-use testing. This comment is supported by detailed legal discussion from General Motors Corporation. Requiring OBD in vehicles over 14,000 pounds GVWR is invalid. This comment is supported by detailed technical arguments from General Motors Corporation. **(General Motors Corporation (IV-D-65))**

RESPONSE: As discussed in the responses to Issue 27, Comments A, B, C, and E, we did not propose Otto-cycle NTE, an in-use testing program for all HD, or OBD for vehicles >14,000 pounds GVWR, and the final rule contains no requirements on these issues. These comments are therefore not relevant to the final rule, and therefore do not need to be responded to here.

ISSUE 28: POST 2004 STANDARDS & ISSUES

Although we did not propose any specific tightening of emission standards beyond the 2004 time frame, we did request comments on a number of issues associated with the potential for tighter emission standards in the future. Issues that we requested comment on included (1) the need for future reductions in NOx and NMHC emissions from HD diesel engines, (2) the time frame in which future standards should be considered, (3) what standards should be considered, (4) what technologies may be available for meeting more stringent HD diesel NOx and/or NMHC levels, (5) the feasibility of advanced diesel aftertreatment technologies, (6) what role, if any, diesel fuel quality plays in enabling future reductions from HD diesel engines, (7) whether additional control of HD diesel PM beyond the current 0.1g/bhp-hr level may be needed in the future to protect the public's health, (8) the air quality need, technical feasibility, and costs associated with implementing more stringent PM standards, (9) the feasibility of the application of PM traps to achieve up to 90 percent reductions from today's levels, (10) the range of PM limits currently being considered by the European Union, namely 0.015 to 0.04 g/hp-hr, (11) what role, if any, diesel fuel quality plays in meeting a more stringent PM standard, and (12) the structure of future emission standards (e.g., fuel neutrality and chassis vs. engine-based testing).

A large number of commenters provided comments on many of these issues. There was widespread support for a second phase of emission reductions from the on-highway heavy-duty sector among states, environmental organizations, and public citizens. These commenters often cited reductions of 90 percent relative to the 2004 levels as appropriate and necessary, and comments often suggested 2007 as the appropriate model year for implementation of tighter standards. Many of these commenters also urged reductions in diesel fuel sulfur levels in conjunction with or prior to implementation of more stringent standards. One commenter suggested that low sulfur diesel fuel was necessary to enable the use of advanced aftertreatment devices in order for the Agency to initiate a program requiring the retrofit of existing HD diesel trucks. The engine manufacturers, stating that tighter future standards will require lower sulfur fuel, generally recommend that EPA pursue a "systems" approach, carefully considering potential standards in the context of available technologies and fuels. Petroleum refiners generally acknowledged that the next step in reducing emissions would require a reduction in fuel sulfur levels, suggesting that this step in diesel fuel reformulation should occur no earlier than 2009. They also suggested that, given their knowledge of diesel aftertreatment, a reduction of 90 percent relative to the 2004 standards may be optimistic.

Following our October, 1999 NPRM, EPA moved forward with a proposal for more stringent emission standards for heavy-duty vehicles and engines that would take effect, if finalized as proposed, in the 2007 to 2010 time frame. The many comments submitted in response to the issues noted above were reviewed and considered by EPA in the development of this proposal for more stringent heavy-duty emission standards. Readers should refer to this recent proposal for more information (see 65 FR 35430, June 2, 2000).

Several commenters also urged EPA to consider addressing emission levels and fuel sulfur levels for non-road diesel engines in a future action. These commenters typically noted the relatively large contribution of non-road engines to NOx and PM emission inventories, and most of these commenters suggest that at a minimum EPA should require low sulfur fuel for non-road engines. As noted under Issue 25.4, the fact that the focus of this rulemaking is on on-highway

heavy-duty engines and vehicles is not meant to imply that controlling emissions from other sources, such as non-road engines, is not important. EPA will address emissions from other sources, including non-road engines, as appropriate, in future rulemaking efforts.