ENVIRONMENTAL PROTECTION AGENCY

40 CFR Parts 85 and 86

[AMS–FRL–6456–3]

RIN 2060–AI12, 2060–AI23

Control of Emissions of Air Pollution From 2004 and Later Model Year Heavy-Duty Highway Engines and Vehicles; Revision of Light-Duty Truck Definition

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice of proposed rulemaking (NPRM).

SUMMARY: We are proposing to take several actions relating to emission standards and test procedures for heavy-duty engines and vehicles intended for operation on roads and highways. The proposed provisions are for the 2004 and later model years. First, we are proposing new more stringent emissions standards and related provisions for all heavy-duty Otto-cycle (*e.g.*, gasoline-fueled) engines and vehicles. Vehicles in this category include large full size pick-up trucks, full size cargo and passenger vans, and the largest sport utility vehicles. For heavy-duty Otto-cycle engines and vehicles, today's proposal would reduce the standards for oxides of nitrogen and hydrocarbons by approximately 75 percent from current standards. Second, we propose to reaffirm that the NMHC+NO_X standard promulgated in October, 1997 for diesel heavy-duty engines is both necessary and feasible. This standard represents about a 50 percent reduction in emissions of nitrogen oxides, as well as reductions in hydrocarbons, from diesel trucks and buses. Third, we are proposing to require on-board diagnostics systems for all heavy-duty vehicles and engines at or below 14,000 lbs gross vehicle weight rating (GVWR), and to revise the on-board diagnostics requirements for diesel light-duty vehicles and trucks. These systems will identify the failure of components of the emissions control system. Fourth, we are proposing the addition of new test procedures and associated standards for heavy-duty diesel engines and vehicles. Fifth, we are proposing to include heavy models of gasoline and diesel-fueled sport-utility vehicles and similar heavy-duty vehicles used primarily for personal transportation in the Tier 2 program that EPA proposed earlier this year. Today's proposal would result in lower emissions of oxides of nitrogen and hydrocarbons, as well as lower particulate matter due to reductions in secondary particulate formation (secondary particulate matter is not emitted directly from the engine, but is formed when emissions of oxides of nitrogen react with ammonia in the atmosphere to produce ammonium nitrate particulates), and would assist states and regions facing ozone air quality problems that are causing a range of adverse health effects, particularly respiratory impairment and related illnesses.

DATES: We must receive your comments on this NPRM by December 2, 1999. A public hearing will be held on November 2, 1999 (EPA has published notice of this hearing on October 22, 1999 (64 FR 56985).). EPA requests that parties who want to testify notify the contact person listed in the **ADDRESSES** section of this document one week before the date of the hearing. More information about commenting on this action and on the public hearing may be found in section XI What are the Opportunities for Public Participation?

ADDRESSES: Written comments should be submitted (in duplicate, if possible) to: EPA Air and Radiation Docket, Attn: Docket No. A–98–32, Room M–1500 (Mail Code 6102), 401 M Street SW, Washington, DC 20460. EPA requests that a copy of the comments also be sent to the contact person listed below. Materials relevant to this proposal have been placed in Docket Nos. A–98–32 and A–95–27 and may be viewed in Room M–1500 between 8:00 a.m. and 5:30 p.m., Monday through Friday. The telephone number is (202) 260–7548 and the facsimile number is (202) 260–4400. A reasonable fee may be charged by EPA for copying docket materials.

The public hearing will be held at Top of the Tower, 1717 Arch Street, 51st Floor, Philadelphia, PA 19103, telephone: 215–567–8787, fax: 215–557–5171.

FOR FURTHER INFORMATION CONTACT: Margaret Borushko, U.S. Environmental Protection Agency, Engine Programs and Compliance Division, 2000 Traverwood Drive, Ann Arbor, MI 48105–2498. Telephone (734) 214–4334; Fax (734) 214–4816; e-mail borushko.margaret@epa.gov.

SUPPLEMENTARY INFORMATION:

Regulated Entities

Entities potentially regulated by this action are those that manufacture and sell new heavy-duty motor vehicles, new heavy-duty engines, and new diesel light-duty motor vehicles in the United States. Regulated categories and entities include:

Category	Examples of regulated entities
Industry	Manufacturers of new heavy-duty motor vehicles and engines. Manufacturers of new diesel light-duty motor vehicles and engines.

This table is not intended to be exhaustive, but rather provides a guide for readers regarding entities likely to be regulated by this action. This table lists the types of entities that EPA is now aware could potentially be regulated by this action. Other types of entities not listed in the table could also be regulated. To determine whether your activities are regulated by this action, you should carefully examine the applicability criteria in §§ 86.001–1 and 86.1801–01. If you have questions regarding the applicability of this action to a particular entity, consult the person listed in the preceding **FOR FURTHER INFORMATION CONTACT** section.

Obtaining Rulemaking Documents Through the Internet

The preamble, regulatory language, regulatory impact analysis, and other related documents are also available electronically from the EPA Internet Web site. This service is free of charge, except for any cost you already incur for Internet connectivity. The electronic version is made available on the day of publication on the primary Web site listed below. The EPA Office of Mobile Sources also publishes **Federal Register** notices and related documents on the secondary Web site listed below.

1. http://www.epa.gov/docs/fedrgstr/EPA-AIR/ (either select desired date or use Search feature)
2. http://www.epa.gov/OMSWWW/ (Look in What's New or under the specific rulemaking topic)

Please note that due to differences between the software used to develop the document and the software into which the document may be downloaded, changes in format, page length, etc. may occur.

TABLE OF ACRONYMS AND ABBREVIATIONS

ABT	Averaging, Banking, and Trading
AECD	Auxiliary Emission Control Device
ALVW	Adjusted Loaded Vehicle Weight
ANPRM	Advance Notice of Proposed Rulemaking
BSFC	Brake-Specific Fuel Consumption
CAA	Clean Air Act
CAP 2000	Compliance Assurance Program for the 2000 and later model years
CARB	California Air Resources Board

TABLE OF ACRONYMS AND ABBREVIATIONS—Continued

CASAC	Clean Air Scientific Advisory Committee
CFF	Clean Fuel Fleet
CO	Carbon Monoxide
DF	Deterioration Factor
DOC	Diesel Oxidation Catalyst
DRI	Desert Research Institute
EGR	Exhaust Gas Recirculation
EMA	Engine Manufacturers Association
EPA	Environmental Protection Agency
FEL	Family Emission Limit
g/bhp-hr	grams per brake-horsepower hour
g/mi	grams per mile
GVWR	Gross Vehicle Weight Rating
HC	Hydrocarbons
HD	Heavy-Duty
HDDE	Heavy-Duty Diesel Engine
HDE	Heavy-Duty Engine
HDEWG	Heavy-Duty Engine Working Group
HDV	Heavy-Duty Vehicle
HEUI	Hydraulically Actuated Electronic Unit Injection
HLDT	Heavy Light-Duty Truck
LDT	Light-Duty Truck
LDV	Light-Duty Vehicle
LEV	Low Emission Vehicle
LLDT	Light Light-Duty Truck
LRT	Load Response Test
MDV	Medium-Duty Vehicle
MEUI	Mechanically Actuated Electronic Unit Injection
MIL	Malfunction Indicator Light
MY	Model Year
NAAQS	National Ambient Air Quality Standards
NCP	Non-Conformance Penalty
NMHC	Non-Methane Hydrocarbon
NMOG	Non-Methane Organic Gas
NO_X	Nitrogen Oxides
NPRM	Notice of Proposed Rulemaking
OBD	On-Board Diagnostics
OEM	Original Equipment Manufacturer
ORVR	Onboard Refueling Vapor Recovery
PM	Particulate Matter
PM_{10}	Particulate Matter of 10 microns or less in diameter
$PM_{2.5}$	Particulate Matter of 2.5 microns or less in diameter
RIA	Regulatory Impact Analysis
SIP	State Implementation Plan
SOP	Statement of Principles
TW	Test Weight
UDDS	Urban Dynamometer Driving Schedule
ULEV	Ultra Low Emission Vehicle
VGT	Variable Geometry Turbocharger
VMT	Vehicle Miles Traveled
VNT	Variable Nozzle Turbocharger
VOC	Volatile Organic Compound

Table of Contents

I. What Is EPA Proposing To Do?

EPA (or, ''the Agency'') is proposing to take several actions relating to emission standards and test procedures for heavy-duty engines (HDEs) and heavy-duty vehicles (HDVs) intended for highway operation.[1] The proposed provisions would become effective starting with the 2004 model year (MY). These actions supplement a June 1996 proposed rule (61 FR 33421, June 27, 1996), in which we proposed new emission standards for heavy-duty diesel engines (HDDE) and heavy-duty Otto-cycle engines and vehicles, and a subsequent October 1997 final rule (62 FR 54694, October 21, 1997), in which we finalized new emission standards for heavy-duty diesel engines.[2]

Currently, EPA has a chassis-based regulatory program for light-duty vehicles (LDVs) and light-duty trucks (LDTs), meaning that the vehicle itself is subject to emission standards and testing. For all heavy-duty vehicles the engine alone is tested and must currently meet engine-based standards.[3] Engine testing currently applies to all diesel-cycle and Otto-cycle heavy-duty vehicles. One of the key elements of today's action is a proposal to begin regulating a subset of heavy-duty vehicles using chassis-based requirements. The heavy-duty vehicles that are proposed to be subject to chassis-based requirements are complete Otto-cycle heavy-duty vehicles with a gross vehicle weight rating (GVWR) below 14,000 pounds.[4,5] In addition, some complete gasoline and diesel-fueled heavy-duty vehicles between 8,500 and 10,000 pounds GVWR are proposed to be incorporated into the Tier 2 program proposed by EPA earlier this year (64 FR 26004, May 13, 1999). Today's proposal can generally be separated into those elements relating to the new chassis-based requirements and those elements that affect the engine-based requirements. The proposals listed below are explained in greater detail in the remainder of this document.

Some of these proposals would harmonize EPA's regulatory programs with California's current medium-duty vehicle (MDV) program (e.g., vehicle-based standards for complete Otto-cycle heavy-duty vehicles below 14,000 pounds GVWR), while others may differ from California's current requirements. These similarities and differences are outlined in the detailed discussion that follows. We request comments on the proposals described below, and encourage commenters to supply relevant data that would help us further assess the proposals.[6]

A. Changes to the Engine-Based Program

The first sections of this proposal describe the proposed revisions to the engine-based program. Some of these proposals would apply to both diesel and Otto-cycle engines, and others would apply uniquely to either diesel or Otto-cycle engines. Proposed requirements that affect the engine-based program include:

- Reaffirmation of the existing 2004 and later model year NMHC+NOx standard for heavy-duty diesel engines.
- New more stringent emission standards for 2004 and later model year Otto-cycle heavy-duty engines.
- A revised averaging, banking, and trading (ABT) program for Otto-cycle heavy-duty engines.
- Revised deterioration factor (DF) requirements for heavy-duty engines.
- New emission standards for heavy-duty diesel engines to improve the assurance that vehicles are emitting low levels of pollutants over a wide range of operation experienced in actual use.
- New supplemental test procedures for heavy-duty diesel engines associated with the proposed new emission standards.[7]

B. Expanding the Otto-Cycle Vehicle-Based Program to Certain Heavy-Duty Vehicles

Additional sections of this proposal describe the proposed chassis-based (or vehicle-based) program for certain heavy-duty vehicles. Many of these proposals result in harmonization with the California Air Resources Board (CARB) Medium-duty Vehicle (MDV)

---

[1] Light-duty vehicles and light-duty trucks are defined as vehicles with a gross vehicle weight rating (GVWR) below 8,500 pounds. Heavy-duty vehicles are vehicles with a GVWR greater than or equal to 8,500 pounds. Heavy-duty engines are engines used in heavy-duty vehicles.

[2] The terms ''diesel'' and ''Otto-cycle'' generally refer to the type of combustion cycle employed by an engine. In a diesel-cycle engine combustion is brought about by the compression of the fuel mixture (compression ignition), whereas in an Otto-cycle engine combustion is achieved by providing a spark to the fuel mixture (spark ignition). Although a generalization for which there are exceptions, diesel-cycle vehicles are generally fueled with diesel fuel and Otto-cycle vehicles are generally fueled with standard gasoline.

[3] Engine-based standards are expressed in terms of emissions per unit of work, whereas chassis-based (or vehicle-based) standards are expressed in terms of amount of emissions per mile driven by the vehicle.

[4] ''Complete'' vehicles are those that are manufactured with their primary cargo carrying container or device attached, whereas ''incomplete'' vehicles are those that are manufactured without the primary cargo carrying container or device attached. Incomplete vehicles (basically the engine plus a chassis) are then manufactured into a variety of vehicles, such as recreational vehicles, panel trucks, dump trucks, fire trucks, and tow trucks.

[5] Gross Vehicle Weight Rating (GVWR) is defined by federal regulation in 40 CFR 86.082–2 as ''The value specified by the manufacturer as the maximum design loaded weight of a single vehicle.'' In other words, it is the weight of the vehicle completely loaded with the maximum load that the manufacturer states the vehicle is capable of carrying.

[6] The current federal standards for Clean Fuel Vehicles are less stringent than the proposed Otto-cycle standards and the existing diesel standards for the 2004 and later model years. *See* 40 CFR 88.105–94. The 2004 and later model year standards proposed today would supercede the current Clean Fuel Vehicle standards, and, if EPA adopts the Otto-cycle standards proposed today and maintains the diesel standards for the 2004 and later model years, the Agency intends to undertake a rulemaking to revise the Clean Fuel Vehicle standards accordingly.

[7] We believe that our compliance program is fundamentally incomplete until a similar form of additional assurance that Otto-cycle engines will meet applicable emission standards in-use can be added to the compliance requirements, but such provisions are not specifically proposed today. Section V of today's proposal describes several important compliance program elements that are not included in today's proposal, but that we intend to finalize such that they can take effect in conjunction with those elements in today's proposal. See section V for more information.

Program. For the vehicle-based program, we are proposing the following elements:

• New standards for 2004 and later model year complete Otto-cycle heavy-duty vehicles with a GVWR below 14,000 pounds.
• The incorporation of certain complete Otto-cycle and diesel vehicles between 8,500 and 10,000 pounds GVWR into the Tier 2 light-duty program. These provisions would be limited to those vehicles designed primarily for personal transportation.
• Vehicle-based testing of all complete heavy-duty Otto-cycle vehicles below 14,000 pounds GVWR for these new standards.
• An averaging, banking, and trading program.
• On-board refueling vapor recovery (ORVR) requirements.
• CAP 2000 provisions.[8]
• Revised useful life requirements.

C. Additional Changes Affecting Heavy-Duty Vehicle and Heavy-Duty Engine Programs

Additional sections describe provisions or issues that apply to both heavy-duty vehicle and engine programs. These proposals include:

• On-board Diagnostics (OBD) requirements for heavy-duty diesel and Otto-cycle vehicles and engines up to 14,000 pounds GVWR.
• Non-Conformance Penalties (NCPs).

D. Heavy-Duty Lead Time Issues and Voluntary Federal Standards

One of the important concepts contained in the rulemaking record, 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 sold to. Our proposal today would implement nationwide standards which would harmonize with California for the majority HD engines and vehicle in 2004 (the exception being incomplete HD Otto-cycle engines.)

Since the finalization of the 1997 rule for 2004 HD diesels, state and local air quality agencies have been counting on the emission reductions from the 2004 standards in order to meet their long-term air quality needs. In addition, as discussed previously in this proposal, the 2004 standards for HD Otto-cycle engines and vehicles will also provide state and local air quality agencies additional needed emission reductions. However, Section 202 of the Clean Air Act requires EPA to provide manufacturers of heavy-duty engines and vehicles four years of lead time between standards. This would require EPA to issue a final rule by the end of 1999 in order to implement new standards in 2004. We are concerned due to the short amount of time between today's proposal and the end of the calendar year that the final rule for today's proposal may not be final until after December 31, 1999, which may prevent a model year 2004 implementation of the standards proposed today. This concern does not apply for the 2004 model year heavy-duty diesel engine standards which were promulgated in 1997 and meet the lead time requirements.

This four year lead time issue for the 2004 standards contained in today's proposal reflects a statutory requirement, not a technological feasibility issue. As demonstrated elsewhere in this proposal, technology is clearly available which will allow manufacturers to meet the proposed HD diesel and HD gasoline standards by 2004.

The lack of more stringent federal 49-state HD standards in 2004 may lead some states with incentive to exercise their rights under Section 177 of the Clean Air Act to adopt the California HD diesel and Otto-cycle standards in order to realize the emission reductions associated with covering vehicles produced in 2004. This could result in a patchwork of emission standards across the country and could present the manufacturers with significant difficulties.

In the event the Agency is unable to finalize the new standards contained in today's proposal by the end of calendar year 1999, we request comment on the appropriateness of EPA's efforts to manage the implementation of these standards and in particular, of establishing a program for those manufacturers willing to cooperate in meeting the requirements in today's proposal. We would expect that manufacturers participating in this program would merely certify their 2004 model year engines to meet all of the emission standards and requirements included in today's proposal. If the proposed standards are not finalized by the end of 1999, mandatory federal standards would apply in model year 2005, with the goal of putting in place all requirements contained in today's proposal. We request comment on whether manufacturers would need to opt-in to such a program, and how such opt-in would take place. In addition, EPA requests comment on incentives to encourage manufacturers to opt into the voluntary program.

II. What Is the Environmental Need for This Proposal?

This section presents information on the negative health and environmental impacts from air pollution from heavy-duty (HD) engines and vehicles, as well as EPA's assessment of the need for additional emission reductions from HD engines and vehicles in order to meet the air quality needs of the U.S. A detailed analysis and explanation of the health impacts and air quality needs was presented in the advanced notice of proposed rulemaking, as well as the preamble and the Regulatory Impact Analysis (RIA) for the proposal and final rule of the 1997 rulemaking for the 2004 standards.[9] The reader should refer to those documents for additional information on this topic.

A. Need for Additional NO_x and NMHC Reductions

1. Health and Welfare Effects From NMHC and NO_x

Oxides of Nitrogen (NO_x) and volatile organic compounds (VOC) are precursors in the photochemical reaction which forms tropospheric ozone. VOC emissions from mobile sources consist mostly of nonmethane hydrocarbons (NMHC). There is a large body of evidence showing that ozone can cause harmful respiratory effects including chest pain, coughing, and shortness of breath, affecting people with compromised respiratory systems and children most severely. In addition, NO_x itself can directly harm human health. Beyond their human health effects, other negative environmental effects are also associated with ozone

[8] The new compliance assurance program for light-duty vehicles and light-duty trucks, known as CAP 2000 (since manufacturers may opt-in for model year 2000), streamlines the existing vehicle certification program, enabling manufacturers to save significant time and money. In addition, it requires manufacturers to test customer-owned in-use vehicles for model year 2001 and beyond. The CAP 2000 program was proposed on July 23, 1998 (63 FR 36954), and finalized on May 4, 1999 (64 FR 23906).

[9] *See* ''Control of Air Pollution for Heavy-Duty Engines, Advanced Notice of Proposed Rulemaking'', Available in EPA Air Docket A–95–27, Docket Item # AMS–FRL, and ''Draft Regulatory Impact Analysis: Control of Emissions of Air Pollution from Highway Heavy-Duty Engines'', available in EPA Air Docket A–95–27, Docket Item # III–B–01, and ''Control of Emissions of Air Pollution from Highway Heavy-Duty Engines; Notice of Proposed Rulemaking'' available in EPA Air Docket A–95–27, Docket Item # III–A–01, and ''Final Regulatory Impact Analysis: Control of Emissions of Air Pollution from Highway Heavy-Duty Engines'', available in EPA Air Docket A–95–27, Docket Item # V–B–01, and ''Control of Emissions of Air Pollution from Highway Heavy-Duty Engines; Final Rule,'' available in EPA Air Docket A–95–27, Docket Item # V–A–01.

and NO_x. Ozone has been shown to injure plants and materials; NO_x contributes to the secondary formation of particulate matter (PM) (nitrates), acid deposition, and the overgrowth of algae in coastal estuaries. These environmental effects, as well as the health effects noted above, are described in the Regulatory Impact Analysis, and additional information may be found in EPA's ''staff papers'' and ''air quality criteria'' documents for ozone and nitrogen oxides.[10, 11, 12, 13]

2. Current Compliance With the Ozone NAAQS

Today, many states are finding it difficult to show how they can meet or maintain compliance with the current National Ambient Air Quality Standard (NAAQS) for ozone by the deadlines established in the Clean Air Act (CAA, or ''the Act'').[14] As of August, 1998, 72 million people outside of California lived in 36 metropolitan areas and two counties designated nonattainment under the 1-hour ozone NAAQS.

In July 1997, EPA established a new 8-hour ozone NAAQS to better protect against longer exposure periods at lower concentrations than the current 1-hour standard. Under the July 1997 rule, the 1-hour NAAQS would still be applicable in certain areas during the transition to the 8-hour standard (62 FR 38856; July 17, 1997). EPA reviewed ambient ozone monitoring data for the period 1993 through 1995 to determine which counties violated either the 1-hour or 8-hour NAAQS for ozone during this time period.[15, 16] Eighty-four counties violated the 1-hour NAAQS during this 3-year period, while 248 counties violated the 8-hour NAAQS. The 84 counties had a 1990 population of 47 million, while the 248 counties had a 1990 population of 83 million. EPA is reviewing more recent air quality data for 1996 and 1997. A preliminary assessment of 1994 through 1996 ozone monitoring data reveals only marginal changes in the number of counties experiencing a nonattainment problem with the 8-hour NAAQS, and essentially no change in the population levels impacted by nonattainment.

On May 14, 1999, a panel of the U.S. Court of Appeals for the District of Columbia Circuit found, by a 2–1 vote, that Clean Air Act sections 108 and 109, as interpreted by EPA in establishing the 8-hour ozone NAAQS (as well as the new NAAQS for $PM_{2.5}$ and PM_{10}), effect an unconstitutional delegation of Congressional power. *American Trucking Ass'ns, Inc., et al.,* v. *Environmental Protection Agency,* Nos. 97–1440, 1441 (D.C. Cir. May 14, 1999). The Court remanded the record to EPA. One judge dissented, finding that the majority's opinion ''ignores the last half-century of Supreme Court nondelegation jurisprudence.'' *Id.*, slip op. at 31. The Court also ruled, regarding the 8-hour ozone NAAQS, that the statute permits EPA to promulgate a revised ozone NAAQS and to designate the attainment status of areas. However, the Court curtailed EPA's ability to require states to comply with the revised ozone NAAQS. Further the Court directed the Agency to determine whether tropospheric ozone has a beneficent effect, and if so, assess ozone's net adverse health effect. In general, the Court did not find fault with the scientific basis for EPA's determinations regarding adverse health effects from ozone. On June 28, 1999, EPA filed a petition for rehearing and petition for rehearing en banc seeking review of the panel's decision.

The Court's decision does not address the provisions of section 202(a), and does not change EPA's belief that the standards in today's proposal are lawful and appropriate under these criteria. We believe that the information provided in this proposal and the draft Regulatory Impact Analysis, as well as the information that EPA relied on in setting the NAAQS for ozone, support a conclusion that ozone can be reasonably anticipated to endanger the public health or welfare. EPA's belief that it is appropriate to seek reductions of NO_X and NMHCs from heavy duty vehicles and engines to protect public health or welfare is not changed by the decision of the court.

3. Future Compliance With the Ozone NAAQS

Local, state and federal organizations charged with delivering cleaner air have mounted significant efforts in recent years to reduce air quality problems associated with ground-level ozone, and there are signs of partial success. NO_X and VOCs appear to have been reduced, and average levels of ozone seem to have begun gradually decreasing. However, this progress is in jeopardy. EPA projects that reductions in ozone precursors that will result from the full implementation of current emission control programs will fall far short of what would be needed to offset the normal emission increases that accompany economic expansion. By the middle of the next decade, the Agency expects that the downward trends will have reversed, primarily due to increasing numbers of emission sources. By around 2020, EPA expects that NO_X levels will have returned to current levels in the absence of significant new reductions.[17] To the extent that some areas are seeing a gradual decrease in ozone levels in recent years, EPA believes that the expected increase in NO_X will likely result in an increase in ozone problems in the future.

The Agency has recently finalized a rulemaking requiring 22 States and the District of Columbia to submit State Implementation Plan (SIP) revisions to reduce specified amounts of emissions of NO_X for the purpose of reducing NO_X and ozone transport across State boundaries in the eastern half of the United States.[18] The specified NO_X reduction for each State varies. In making this decision EPA relied upon, among other items, ozone modeling studies for the eastern U.S. In the baseline scenario for these modeling runs EPA included the emission reductions expected from the 2004 HDDE standards. These modeling runs concluded that significant additional NO_X reductions beyond the baseline case were necessary from 22 eastern States in order to meet the ozone NAAQS standards. The NO_X emission reductions from the 2004 HDDE standards are assumed by these models to be part of the reductions that will be needed to meet the ozone NAAQS in these areas. The Agency did not analyze the specified reductions that would be required by the rule if the baseline did not include the 2004 HDDE standards.

The deadline for submission of SIPs was recently stayed by a panel of the Court of Appeals for the D.C. Circuit pending further review. EPA believes that the October 27, 1998 rule is fully consistent with the Clean Air Act and

[10] U.S. EPA, 1996, Review of National Ambient Air Quality Standards for Ozone, Assessment of Scientific and Technical Information, OAQPS Staff Paper, EPA–452/R–96–007.

[11] U.S.EPA, 1996, Air Quality Criteria for Ozone and Related Photochemical Oxidants, EPA/600/P–93/004aF.

[12] U.S. EPA, 1995, Review of National Ambient Air Quality Standards for Nitrogen Dioxide, Assessment of Scientific and Technical Information, OAQPS Staff Paper, EPA–452/R–95–005.

[13] U.S.EPA, 1993, Air Quality Criteria for Oxides of Nitrogen, EPA/600/8–91/049aF.

[14] See 42 U.S.C. 7401 *et seq.*

[15] This use of the term ''nonattainment'' in reference to a specific area is not meant as an official designation or future determination as to the attainment status of the area.

[16] See 63 FR 57356, October 27, 1998, ''Finding of Significant Contribution and Rulemaking for Certain States in the Ozone Transport Assessment Group Region for Purposes of Reducing Regional Transport of Ozone.''

[17] See Chapter 2 of the draft Regulatory Impact Analysis for this proposal.

[18] See 63 FR 57356, October 27, 1998, ''Finding of Significant Contribution and Rulemaking for Certain States in the Ozone Transport Assessment Group Region for Purposes of Reducing Regional Transport of Ozone.''

should be upheld. However, it should be noted that if the emission reductions sought by the SIP call are not achieved, it would be more difficult to attain the NAAQS for ozone.

In addition, many states (including western states) have also included the emission reductions projected from the 2004 HDDE standards in their State Implementation Plans. This demonstrates that these states are relying on these emission reductions to meet the ozone NAAQS.

4. Contribution of HD Diesel and Gasoline Engines to Total VOC and NO_X Inventories

HD engines and vehicles are important contributors to the national inventories of NO_X emissions, and they contribute moderately to national VOC pollution. The draft RIA for this proposal describes in detail recent emission inventory modeling completed by EPA for this proposal. Table 1 summarizes EPA's current estimates for national NO_X and VOC contributions from major source categories.

TABLE 1.—2000 NATIONAL NO_X AND VOC EMISSIONS

[thousand short tons per year]

Emission source	NO_X	NO_X %	VOC	VOC %
Light-Duty Vehicles	4,420	19	4,098	25
Heavy-Duty Diesel Vehicles	2,274	10	246	1
Heavy-Duty Gasoline Vehicles	318	1	198	1
Nonroad Engines and Vehicles	5,343	23	2,485	15
Other (Stationary Point and Area Sources)	10,656	47	9,567	58
Total Nationwide Emissions	22,831	....	16,594	....

It should be noted that Table 1 does not include estimated NO_X emission impacts associated with the previously produced HD diesel engines at issue in the recent enforcement action involving the government and several HD diesel engine manufacturers. The relationship of these consent decrees to today's proposed rule is described in section III.D. The excess NO_X emissions from these engines are substantial, and would significantly increase the estimated contribution from HD diesel vehicles presented in Table 1. However, as discussed in section VI.A of this preamble, we did not update our emission inventory model to include the impact on these previously produced engines for this proposal.

Notwithstanding these excess emissions, Table 1 indicates that HD gasoline and diesel vehicles will represent approximately 11 percent of national NO_X emissions and two percent of national VOC emissions in the year 2000. The Regulatory Impact Analysis document for this proposal contains updated emission inventory modeling for HD vehicles. The results show that without additional HD NO_X control beyond the 1998 standards, national NO_X emissions from HD vehicles would decline between 2000 and 2005, but this trend would stop in 2005. After 2005, NO_X emissions from the HD vehicle fleet would increase as a result of future growth in the HD vehicle market without additional emission controls. A similar trend is seen for national NMHC emissions from HD vehicles; however, NMHC emissions are projected to decrease until approximately 2010, after which changes in the make-up of the fleet result in an increase in the NMHC emissions from HD vehicles (*see* Chapter 5 of the draft RIA).

We estimate that the HD diesel and gasoline standards contained in this proposal will result in a combined reduction by the year 2020 of 1,629,000 tons of NO_X per year and 54,000 tons of hydrocarbons (HC) per year. Section VI of this preamble (''What are the Environmental Benefits of this Proposal?'') as well as the draft RIA for this proposal contain more detailed information on the Agency's projected benefits from today's proposal.

B. Need for Additional PM Reductions

1. Health and Welfare Effects From PM

Particulate matter is the general term for the mixture of solid particles and liquid droplets found in the air. Particulate matter includes dust, dirt, soot, smoke, and liquid droplets that are directly emitted into the air from natural and manmade sources, such as windblown dust, motor vehicles, construction sites, factories, and fires. Particles are also formed in the atmosphere by condensation or the transformation of emitted gases such as sulfur dioxide, nitrogen oxides, and volatile organic compounds. Particulate matter, like ozone, has been linked to a range of serious respiratory health problems. Scientific studies suggest a likely causal role of ambient particulate matter in contributing to a series of health effects. The key health effects categories associated with particulate matter include premature mortality, aggravation of respiratory and cardiovascular disease (as indicated by increased hospital admissions and emergency room visits, school absences, work loss days, and restricted activity days), changes in lung function and increased respiratory symptoms, changes to lung tissues and structure, and altered respiratory defense mechanisms. PM also causes damage to materials and soiling. It is a major cause of substantial visibility impairment in many parts of the U.S.

Motor vehicle particle emissions and the particles formed by the transformation of motor vehicle gaseous emissions (secondary particulates) tend to be in the fine particle range. Fine particles (those less than 2.5 micrometers in diameter) are a health concern because they easily reach the deepest recesses of the lungs. Scientific studies have linked fine particles (alone or in combination with other air pollutants), with a series of significant health problems, including premature death; respiratory related hospital admissions and emergency room visits; aggravated asthma; acute respiratory symptoms, including aggravated coughing and difficult or painful breathing; chronic bronchitis; and decreased lung function that can be experienced as shortness of breath.

These effects are discussed further in the RIA for this proposal, as well as the RIA for the 1997 final rule for the 2004 standards, and additional information may be found in EPA's ''staff paper'' and ''air quality criteria document'' for particulate matter.[19]

2. Current and Future Compliance With the PM_{10} NAAQS

The first NAAQS for particulate matter regulated total suspended

[19] U.S. EPA, 1996, Air Quality Criteria for Particulate Matter, EPA/600/P–95/001aF.

particulate in the atmosphere. In 1987, EPA replaced that standard with one for inhalable PM (PM_{10}—particles less than ten microns in size), because the smaller particles, due to their ability to reach the lower regions of the respiratory tract, are more likely responsible for the adverse health effects. The major source of PM_{10} is fugitive emissions from agricultural tilling, construction, fires, and unpaved roads. Some revisions to the PM_{10} standards were made in 1997. EPA has also recently added new fine particle standards for particles less than 2.5 microns in size ($PM_{2.5}$). Most of the particulate due to motor vehicles falls in the fine particle category. These standards have both an annual and a daily component. The annual component is set to protect against long-term exposures, while the daily component protects against more extreme short-term events.

As noted above, on May 14, 1999, a panel of the U.S. Court of Appeals for the District of Columbia Circuit found, by a 2–1 vote, that Clean Air Act sections 108 and 109, as interpreted by EPA in establishing the new NAAQS for $PM_{2.5}$ and PM_{10}, effect an unconstitutional delegation of Congressional power. *American Trucking Ass'ns, Inc., et al.,* v. *Environmental Protection Agency,* Nos. 97–1440, 1441 (D.C. Cir. May 14, 1999). The Court remanded the record to EPA. The court vacated the new PM_{10} standard, but has not vacated the $PM_{2.5}$ standard. *See American Trucking Ass'ns, Inc., et al.,* v. *Environmental Protection Agency,* No. 97–1440 (D.C. Cir. June 18, 1999).

Compliance with the current PM_{10} standard continues to be a problem. According to the 1996 EPA Air Quality and Emissions Trends report, there were 7 million people living in 15 counties across the U.S. which exceeded the PM_{10} NAAQS in 1996.[20]

EPA recently projected ambient PM_{10} levels and the number of U.S. counties expected to be in violation of the revised PM_{10} NAAQS in 2010.[21] Based on the 1990 census, about 10 million people live in the 11 counties projected to be in nonattainment of the revised PM_{10} NAAQS.

3. Contribution of HD Diesel and Gasoline Vehicles to PM Inventories

a. Contribution to National PM_{10} Inventories

The national inventory of PM_{10} is dominated by natural sources (wind erosion) and so-called miscellaneous sources, which include paved and unpaved road dust, agricultural crops, fugitive dust, and dust from construction activities. Together natural and miscellaneous sources represented approximately 90 percent of national PM_{10} emissions in 1996. Since these sources are not readily amenable to regulatory standards and controls, it is appropriate to focus on more traditional ''controllable'' portions of the particulate pollution problem when considering the need for PM controls. Excluding natural and miscellaneous sources, HD vehicles (gasoline and diesel) represent approximately five percent of the remaining man-made sources of PM_{10} in 1996, virtually all (95 percent) of which is from diesel vehicles.[22]

In the proposal for the 1997 final rule for the 2004 standards, EPA presented data on future projections of mobile and stationary source PM_{10} national emission inventories out to the year 2010, as well as a break-down of mobile sources into on-highway light-duty, on-highway heavy-duty, and nonroad categories (*see* 61 FR 33432–33440, June 27, 1996). These projections showed that without additional future controls on PM or NO_X emissions, annual PM emissions (tons/year) for all mobile sources would begin to rise after the year 2000. The Regulatory Impact Analysis document for this proposal presents the results of updated emission modeling specifically for HD vehicles. These results show that the annual national PM_{10} emissions from HD vehicles (tons/year) are expected to decline between now and approximately the year 2010, after which increases in the size of the fleet will result in a steady increase into the future (*see* Chapter 5 of the draft RIA).

b. Source-apportionment Studies for Diesel PM

Discussion of PM inventories from HD vehicles, and in particular HD diesel vehicles which represent the vast majority of the HD PM emissions, can be discussed in terms other than just contributions to national yearly emission inventories. In recent years several research groups have been looking at the contribution of diesel PM in selected urban and rural areas. In several cases these studies indicate that the contribution from diesels in certain urban areas to PM emissions is much larger than is indicated by national PM inventories. Several studies have been performed in the past several years which have attempted to apportion particulate matter collected at specific sites to individual source categories, *i.e.*, source apportionment studies. These studies collect particulate matter samples in the ambient air which are subsequently analyzed using various chemical techniques in order to estimate what sources contributed to the sample.

There have been a number of source apportionment studies for mobile source particulate emissions. Among the most recent and thorough are studies by the state of Colorado (the Northern Front Range Air Quality Study [NFRAQS]) for the Denver area and the California Institute of Technology for the Los Angeles area. These studies emphasize particulate smaller than 2.5 microns. Also, EPA has a cooperative agreement with the Desert Research Institute (DRI); under this agreement, DRI is completing a detailed report on mobile source particulates; a major portion of this report summarizes source apportionment studies for particulates that include those from mobile sources.[23]

Source apportionment work involves collecting and analyzing a number of ambient particulate samples from a number of specific sources such as gasoline and diesel vehicles. Some samples of high molecular weight hydrocarbons are frequently also collected and analyzed, these hydrocarbons can be transformed to particulates in the ambient air; such compounds include polycyclic organic matter. These samples are analyzed in detail to determine what specific compounds are present including those in trace amounts that are more common from one source type than from others, these traces are called source signatures. From these analyses, a number of source signatures are developed including those for gasoline and diesel vehicles. Source apportionment work also involves collecting and analyzing a larger number of ambient particulate and, frequently, high molecular weight hydrocarbon. The compounds found in these samples can be compared to the source signatures to determine what and how much individual sources contribute to the ambient particulate.

[20] U.S. EPA, January 1998, ''National Air Quality and Emissions Trends Report, 1996'', EPA 454/R–97–0013.

[21] Regulatory Impact Analyses for the Particulate Matter and Ozone National Ambient Air Quality Standards and Proposed Regional Haze Rule, Innovative Strategies and Economics Group, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, N.C., July 16, 1997.

[22] U.S. EPA, December 1997, ''National Air Pollutant Emission Trends, 1900–1996'', EPA–454/R–97–011.

[23] Draft report for EPA from the Desert Research Institute, June 30, 1998, Available in EPA Air Docket A–98–32, Item # II–A–01.

Source apportionment work is subject to complications and uncertainty. Thus, no single study should be considered definitive. Additional information on source apportionment techniques, and the uncertainties associated with the techniques, can be found in Chapter 2 of the RIA for this proposal.

The NFRAQS study analyzed ambient particulate samples in the Colorado area including Denver using data it collected on the chemical speciation from specific source types to determine how much various mobile and stationary source types contribute to $PM_{2.5}$. Authorized by Colorado state legislation, the total study was funded by 37 government, industry, and trade association groups. The many outputs and conclusions from the NFRAQS will not be discussed here, only source apportionment results for diesel engines are summarized. Complete copies of the NFRAQS are available from the following World Wide Web site, http://charon.cira.colostate.edu/. The NFRAQS included several time periods and several locations in and around Denver. Two locations, Brighton and Welby, during the winter of 1997 included the most detailed sampling and analysis, which allowed the researchers to estimate very detailed source specific contributions, including the contributions to $PM_{2.5}$ from diesel exhaust (all diesel, nonroad and on-highway sources were not differentiated). Based on this work, it was estimated that diesel exhaust sources contributed 10 percent of the total mass of $PM_{2.5}$ in the areas of Brighton and Welby in the winter of 1997.

Similar work has been done for the Los Angeles area by a group of researchers at the California Institute of Technology. This work concluded that direct emissions from diesel exhaust represented approximately 30 percent of fine PM mass on an annual basis in downtown Los Angeles in 1982.[24] In follow-on work looking at the city of Claremont, California in 1987, direct diesel exhaust was found to represent approximately 13 percent of $PM_{2.5}$ mass, and 9 percent of PM_{10} mass.[25]

The California Institute of Technology has also collected ambient particulate in the Boston, MA and Rochester, NY areas. These samples, especially those for Boston, show that carbonaceous particulate is the largest single constituent in $PM_{2.5}$ for these areas. Mobile source particulate, including diesels, is an important contributor to carbonaceous particulate. The Boston and Rochester samples have not yet been used for source apportionment work.

Other ambient samples collected in the eastern U.S. such as Washington, DC show carbonaceous particulate to be an important constituent of $PM_{2.5}$, although sulfates is a somewhat larger constituent and nitrates a much smaller constituent. Particulate samples collected in the western U.S. such as in Spokane, WA, Phoenix, AZ and the San Joaquin Valley of California show that carbonaceous particulate is the major constituent with sulfates/nitrates being lesser constituents although nitrates are more important in southern California than elsewhere in the United States. This work is summarized in the EPA report ''National Air Pollutant Emission Trends, 1900–1996.'' [26]

The reports on source apportionment summarized in this section indicate that the contribution of diesel engines to PM inventories in several local areas around the U.S. are much higher than what would be assumed from looking only at the estimates presented in national PM emission inventories. One possible explanation for this is the concentrated use of diesel engines in certain local or regional areas which is not well represented by the national, yearly average presented in national PM emission inventories.

C. Air Toxics From HD Engines and Vehicles

In addition to contributing to the health and welfare problems associated with exceedances of the National Ambient Air Quality Standards for ozone and PM_{10}, emissions from HD diesel and Otto-cycle vehicles include a number of air pollutants that increase the risk of cancer or have other negative health effects. These air pollutants include benzene, formaldehyde, acetaldehyde, 1,3-butadiene, and diesel particulate matter. For several of these pollutants, motor vehicle emissions are believed to account for a significant proportion of total nation-wide emissions. All of these compounds are products of combustion; benzene is also found in nonexhaust emissions from gasoline-fueled vehicles. These reductions in hydrocarbon emissions from HD vehicles resulting from today's proposal will further reduce the potential cancer risk and other health risks from these air toxics (other than diesel PM) because many of these pollutants are themselves VOCs. Diesel engine particulate matter is also a potential concern because of its possible carcinogenic and mutagenic effects on people. Diesel PM is made of hundreds of chemical species, including many organic and metallic compounds. Researchers have been investigating the potential health hazards associated with exposure to diesel PM for many years.[27] EPA's Office of Research and Development is currently updating the EPA's diesel emission health assessment document. However, the document has only been released as a preliminary draft, and is currently undergoing review by the Clean Air Scientific Advisory Committee. A final version is not expected to be available until late 1999.[28]

The California Air Resources Board and the California Office of Environmental Health Hazard Assessment (COEHHA) have undertaken an assessment of the cancer and non-cancer effects from exposure to diesel exhaust, including the particulate matter component of diesel exhaust, to determine whether diesel exhaust should be classified as a Toxic Air Contaminant (TAC) under California law. The evaluation of diesel exhaust by CARB and COEHHA began in 1989, in June of 1998 a Staff Report was published which recommended that diesel exhaust be classified as a TAC.[29] In a CARB Board hearing held in August, the Board decided to identify diesel exhaust particulate matter as a TAC.[30]

EPA will be addressing the issues raised by air toxics from motor vehicles and their fuels in a separate rulemaking that EPA is initiating in the near future under section 202(l)(2) of the Act. That rulemaking will address the emissions of hazardous air pollutants from motor vehicles and fuels, and the appropriate level of control of hazardous air pollutants from these sources.

III. What Is the Important Background Information for This Proposal?

Under EPA's classification system, heavy-duty vehicles are those with a

[24] ''Source Apportionment of Airborne Particulate Matter Using Organic Compounds as Tracers'', J.J. Schauer, W.F. Rogge, L.M. Hildemann, M.A. Mazurek, and G.R. Cass, Atmospheric Environment, Vol. 30, No. 22, 1996.

[25] ''Source Contributions to the Size and Composition Distribution of Urban Particulate Air Pollution'', M.J. Kleeman and G.R. Cass, Atmospheric Environment, Vol. 32, No. 16, 1998.

[26] ''National Air Pollutant Emission Trends, 1900–1996'', EPA Report 454/R–97–011, December 1997.

[27] ''Diesel Exhaust: A Critical Analysis of Emissions, Exposure, and Health Effects'', Health Effects Institute, April, 1995.

[28] ''Preliminary Draft—Health Assessment Document for Diesel Emissions'', U.S. EPA, February 1998, EPA 600/8–90/057C.

[29] California Air Resources Board—Staff Report—''Proposed Identification of Diesel Exhaust as a Toxic Air Contaminant'', June 1998.

[30] California Air Resources Board, Resolution 98–35, August 27, 1998.

GVWR of 8,500 pounds or more.[31] The State of California classifies the lighter end of this class—up to 14,000 pounds GVWR—as ''medium-duty vehicles.'' Heavy-duty engines are engines used in heavy-duty vehicles. Heavy-duty engines and vehicles are used in a wide range of applications, from large full size pick-up trucks to the largest commercial trucks. Because one type of heavy-duty engine may be used in many different applications, EPA emission standards for the heavy-duty class of vehicles have historically been based on the emissions performance of the engine (and any associated aftertreatment devices) as tested separately from the vehicle chassis.

Highway HDEs are categorized into diesel-cycle (compression-ignited) and Otto-cycle (spark-ignited) engines. Most diesel-cycle engines are fueled by diesel fuel, but heavy-duty diesel-cycle engines can also be fueled by methanol or natural gas. The heavy-duty diesel engine class is further subdivided by EPA into three subclassifications or ''primary intended service classes''; light, medium, and heavy HDDEs (*see* 40 CFR 86.090–2). HDDEs are categorized into one of the three subclasses depending on the GVWR of the vehicles for which they are intended, the usage of the vehicles, the engine horsepower rating, and other factors. The subclassifications allow EPA to more effectively set requirements that are appropriate for the wide range of sizes and uses of HDDEs.

Most highway heavy-duty Otto-cycle vehicles and engines are gasoline-fueled, but may also be fueled with alternative fuels including methanol and gaseous fuels such as natural gas. Heavy-duty Otto-cycle vehicles and engines include large full size pick-up trucks, full size cargo and passenger vans, and the largest sport utility vehicles. Approximately 75 percent of heavy-duty Otto-cycle vehicles are in the 8,500–10,000 pound GVWR range, and the vast majority of these are sold as ''complete'' vehicles. The majority of heavy-duty Otto-cycle vehicles above 10,000 pounds GVWR are sold as ''incomplete'' vehicles, meaning that they are manufactured without their primary cargo carrying container or device attached. These incomplete vehicles (basically the engine plus a chassis) are then manufactured into a variety of vehicles, including recreational vehicles, panel trucks, tow trucks, and dump trucks.

EPA's NO_X standard for 1998 and later model year diesel and Otto-cycle heavy-duty engines is 4.0 grams per brake horsepower-hour (g/bhp-hr). The hydrocarbon standards for 1998 and later model year Otto-cycle engines are 1.1 g/bhp-hr for engines used in lighter vehicles (8500 to 14,000 pounds GVWR) and 1.9 g/bhp-hr for engines used in heavier vehicles (greater than 14,000 pounds GVWR), and the 1998 and later model year hydrocarbon standard for HDDEs is 1.3 g/bhp-hr. EPA currently requires testing of the engine (with emissions control systems in place) rather than the entire vehicle. Thus, the standards are in units of g/bhp-hr (i.e., grams of emissions per unit of work the engine performs over the test cycle), rather than the grams-per-mile unit currently used for testing passenger cars and light-duty trucks.

This proposed rulemaking is the continuation of a rulemaking process for heavy-duty engines which began in 1995 with an Advanced Notice of Proposed Rulemaking (ANPRM) (60 FR 45580, August 31, 1995). As discussed below, a 1996 Notice of Proposed Rulemaking proposed the same NMHC+NO_X standards for both Otto-cycle and diesel engines (61 FR 33421, June 27, 1996). However, EPA did not finalize the proposed NMHC+NO_X standard for Otto-cycle engines in the final rule published in October 1997 (62 FR 54694, October 21, 1997). EPA did finalize a new NMHC+NO_X emission standard for HDDEs, starting with the 2004 model year, but committed to review the appropriateness of this standard in 1999. This NPRM thus addresses two broad issues that remain from earlier rulemaking efforts—a review of the NMHC+NO_X standard for diesel engines and a supplemental proposal addressing new NMHC+NO_X standards for heavy-duty Otto-cycle engines and vehicles. The previous rulemaking documents, and the documents referenced therein (*see* EPA Air Docket No. A–95–27), contain extensive background on the engines and vehicles, the affected industry, and the need for lower emissions standards.

A. Statement of Principles and Rulemaking History

In July of 1995, EPA, the California Air Resources Board, and heavy-duty engine manufacturers representing over 90 percent of annual nationwide engine sales signed a Statement of Principles (SOP) that established a framework for a proposed rulemaking to address concerns regarding the growing contribution of heavy-duty engines to air pollution problems. The SOP contained levels for a new proposed standard for NMHC+NO_X that would become effective in model year 2004. The SOP also contained several key provisions in addition to the standards. The SOP discusses the need to review in 1999 the technological feasibility of the NMHC+NO_X standard and its appropriateness under the Clean Air Act. Also, the SOP outlines a plan for developing technology with the goal of reducing NO_X emissions to 1.0 g/bhp-hr and particulate matter to 0.05 g/bhp-hr while maintaining performance, reliability, and efficiency of the engines. EPA sought early comment on the general regulatory framework laid out in the SOP in an ANPRM on August 31, 1995 (60 FR 45580), then subsequently issued an NPRM on June 27, 1996 (61 FR 33421).

On October 21, 1997, EPA issued a final rule (62 FR 54694). The centerpiece of the final rule was the new NO_X + NMHC standard of 2.4 g/bhp-hr (or 2.5 g/bhp-hr with a 0.5 g/bhp-hr NMHC cap) for 2004 and later model year heavy-duty diesel-cycle engines. The rule also adopted other related compliance provisions for diesel-cycle heavy-duty engines beginning with the 2004 model year, as well as revisions to the useful life for the heavy heavy-duty diesel engine service class. As explained in the following section, no new standards were finalized for on-highway heavy-duty Otto-cycle engines.

The final rule also contained modified ABT provisions for heavy-duty diesel engines, allowing EPA to finalize a more stringent engine standard than might otherwise be appropriate under the CAA, since ABT reduces the cost and improves the technological feasibility of achieving the NMHC+NO_X standard. The changes to the ABT program provide the manufacturers with additional product planning flexibility and the opportunity for a more cost-effective introduction of product lines meeting the new standard. We also believe that the ABT program can create an incentive for the early introduction of new emission control technology. EPA did not finalize new ABT provisions for Otto-cycle engines because EPA did not take action at that time on new standards for those engines. In summary, engine manufacturers will be able to generate credits under the new program beginning with the 1998 model year for use only in 2004 and later model years. The credits in the modified program will have unlimited life, as opposed to the three year credit life contained in the current HD program. Also, engines

[31] The Clean Air Act defines heavy-duty vehicles as those with a GVWR of 6,000 pounds. However, EPA has classified vehicles between 6,000 and 8,500 pounds GVWR as light-duty vehicles, while treating them as heavy-duty for statutory purposes. Vehicles weighing between 6,000 and 8,500 pounds GVWR are not addressed generally in this proposed rulemaking.

with certification levels at or below a certain cut point are able to generate undiscounted credits. Credits generated by engine families certified above the specified cut point are discounted by 10 percent for purposes of banking and trading. The pre-existing ABT program was retained for engine families using credits before 2004, and for Otto-cycle engines which cannot earn credits in the modified program, as noted above. In 2004, the certification level cut-point is adjusted to reflect the implementation of the new standard.

EPA also finalized several provisions to help ensure in-use durability. First, EPA increased the useful life period for heavy heavy-duty diesel engines to 435,000 miles. This new useful life represents a 50 percent increase and is more representative of the durability of current and future heavy heavy-duty diesel engines. In addition, longer allowable maintenance intervals were finalized for some critical emission-control components, including exhaust gas recirculation (EGR) systems, catalysts, and other add-on emissions control components. Generally, the maintenance intervals for the components are set at 100,000 miles for light heavy-duty diesel engines and 150,000 miles for medium and heavy heavy-duty diesel engines. Warranty regulations were also revised to better reflect current industry practices.

Other provisions of the October, 1997 final rule address the period after the manufacturer's responsibility for emission control ends, including engine rebuilding. One of those provisions requires engine manufacturers to establish a section in the owner's manual for add-on components that includes recommendations for maintenance and diagnosing malfunction. In addition, all on-board monitoring used to satisfy the engine's allowable maintenance must not be designed to turn off after the end of the useful life. Finally, EPA established provisions to address engine rebuilding which specify what actions are needed to ensure proper operation of emissions control components and ensure that rebuilding does not result in loss of emissions control. Removal or disabling of emissions related components, resulting in a higher emitting vehicle, are considered tampering.

B. 1999 Review of Heavy-Duty Diesel Engine NMHC+NO_X Standards

In addition to the elements of the final rule described above, EPA finalized a regulatory provision providing for a 1999 review of the new NMHC+NO_X emission standard for HDDEs. EPA committed to ''reassess the appropriateness of the standards under the Clean Air Act, including the need for and technical and economic feasibility of the standards based on information available in 1999'' (*See* 62 FR 54699, October 21, 1997). This provision was put in place because the technologies required to meet the 2004 NMHC+NO_X standard for HDDEs were, at the time the standard was finalized, not yet fully developed and proven. This commitment was spelled out in regulatory language in the final rule in 40 CFR 86.004–11, paragraph (a)(1)(i)(E), which reads:

> No later than December 31, 1999, the Administrator shall review the emissions standards set forth in paragraph (a)(1)(i) of this section and determine whether these standards continue to be appropriate under the Act.

In the preamble to the 1997 final rule EPA outlined the three potential outcomes of the 1999 review: further tightening of the NMHC+NO_X standard, no change to the standard, or a relaxation of the standard. The preamble noted that if EPA determined through the 1999 review process that a tighter standard was feasible and appropriate under the Clean Air Act, such tighter standard would be proposed. Conversely, if EPA's 1999 review process concluded that the 2004 NMHC+NO_X standard was not technologically feasible, the 1997 preamble outlined alternative less stringent sets of standards that EPA would propose. These alternative less stringent standards would depend on EPA's conclusions regarding the necessity for diesel fuel changes and, if changes were found to be needed, whether or not EPA took action to require such changes. Specifically, the preamble stated that if EPA finds through the 1999 review process that the existing 2004 NMHC+NO_X standard is not feasible, a standard no higher than 2.9 g/bhp-hr NMHC+NO_X (or 3.0 g/bhp-hr NMHC+NO_X with a limit of 0.6 g/bhp-hr NMHC) would be proposed. If EPA were to find that changes to diesel fuel would be necessary to meet the 2004 NMHC+NO_X standards, and if EPA did not engage in a rulemaking to make such changes, then standards no higher than 3.4 g/bhp-hr NMHC+NO_X (or 3.5 g/bhp-hr NMHC+NO_X with a limit of 0.6 g/bhp-hr NMHC) would be proposed.

While the specific regulatory provision is limited to the NMHC+NO_X standard for review in 1999, in the preamble to the final rule EPA committed to investigating or seeking comment on several other issues in the context of the 1999 review. These additional issues include:

- An evaluation of whether the appropriateness and technical feasibility of the 2004 standards depend upon changes to diesel fuel.
- A reassessment of the appropriateness of the 2004 NMHC+NO_X standard in the context of the current PM standard.
- Non-conformance penalty provisions for the 2004 HDDE standards.

C. Proposal for Heavy-Duty Gasoline Engine Standards

1. Summary of Comments on 1996 NPRM

As was noted above, EPA proposed the same NMHC+NO_X standard for diesel and Otto-cycle heavy-duty engines in the 1996 NPRM. In the comment period following the NPRM, several commenters urged the Agency to reconsider its proposal for Otto-cycle engines. The commenters argued that the proposal ignored the true low emissions capability of gasoline-powered vehicles equipped with advanced three way catalysts. Environmental groups provided comments highlighting manufacturers' certification data for the 1996 model year, which included some engine families with emission levels considerably below the standards proposed for the 2004 model year. One commenter recommended that the proposed standard be phased in earlier than 2004 for Otto-cycle engines since the emissions control technology capable of meeting the NMHC+NO_X standard was more advanced for Otto-cycle engines than for diesel engines.

Manufacturers commented that the proposed standard was appropriate for Otto-cycle engines and that EPA should not use certification data as a basis for determining the feasibility of a lower standard. Manufacturers noted that due to the potential for in-use deterioration of catalysts and oxygen sensors, they must design to emissions targets and certification levels well below the standards. 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. Manufacturers argued that this variation in in-use operation has an impact on emission system durability not represented by engine certification data and deterioration factors. They argued that it is necessary to certify engines to levels well below the standards to ensure in-use compliance of all engines. One manufacturer presented light-duty vehicle and light-duty truck data to demonstrate that certification levels were about half the standard while some vehicles' in-use emissions levels were higher although not above the standard.[32]

2. Analysis Leading to Decision To Not Finalize Otto-Cycle Standards

EPA, in deciding whether to finalize the NMHC+NO_X standard as originally proposed, had to determine if the proposed standards met the requirements of section 202(a)(3)(A) of the Clean Air Act.[33] For Otto-cycle engines, EPA examined 1997 model year certification data and found some engines certified to very low emissions levels. The certification data for 1997 showed a large number of engine families emitting at or below the 2004 levels as they were proposed, with some engines certified at emission levels only ten to twenty percent of the proposed 2004 emission standards. Examples of these engines are listed in Table 2.[34]

TABLE 2.—1997 MY HEAVY-DUTY OTTO-CYCLE ENGINE CERTIFICATION DATA

Engine size (liter)	NO_X certification level (g/bhp-hr)	HC certification level (g/bhp-hr)	NO_X + HC (g/bhp-hr)
4.3	1.2	0.3	1.5
5.4	0.2	0.1	0.4
5.7	1.4	0.1	1.5
6.8	0.1	0.1	0.2
7.4	1.2	0.4	1.6
8.0	2.2	0.1	2.3
Emission Standards	5.0	*1.3	N/A

*(1.9 above 14,000 pounds GVWR)

EPA also examined certification data for California vehicles. California's MDV program requires all complete heavy-duty vehicles (i.e., all vehicles that exit the manufacturer's assembly line with their cargo carrying device or container attached) up to 14,000 pounds GVWR to be certified on the chassis-based (vehicle) federal test procedure (EPA currently requires engine-based testing of vehicles in this class). Table 3 lists examples of model year 1997 California vehicle certification results for vehicles above 8,500 pounds GVWR.[35] These vehicles were required to meet the California Tier 1 standards which are listed on the table. Starting with the 1998 MY, California is requiring manufacturers to begin phase-in of vehicles meeting more stringent Low Emission Vehicle (LEV) standards which are also listed in Table 3 for these vehicles.

TABLE 3.—1997 MY CALIFORNIA MEDIUM-DUTY VEHICLE CERTIFICATION DATA

[120,000 mile]

Engine size (liter)	NO_X level (g/mile)	HC level (g/mile)	NO_X+HC (g/mile)
5.4	0.20	0.220	0.42
5.7	0.88	0.160	1.04
6.8	0.42	0.300	0.72
7.4	0.48	0.210	0.69
7.5	0.24	0.190	0.43
8.0	0.51	0.234	0.74
Tier 1 standards	1.53	0.560	N/A
LEV standards	0.90	0.280	N/A

EPA understands that manufacturers have established certification levels which represent typical vehicle usage and that manufacturers have given themselves a significant margin between the certification levels and the standards to account for variability including more severe usage and deterioration. However, EPA found that some 1997 model year engines were certified to very low levels even taking the need for a compliance margin into consideration. At the time, however, EPA did not believe it was appropriate, given the lack of a full opportunity for notice and comment, and the need for more thorough data and analyses, to proceed directly to finalizing standards tighter than those originally proposed for heavy-duty Otto-cycle engines. For these reasons, EPA did not finalize the proposed standards for Otto-cycle engines and asserted that more stringent standards might be reasonably achievable in the 2004 model year time frame. With the lead time available for the 2004 time frame and in the context of EPA's emission control program at the time, EPA concluded in 1997 that final action establishing an appropriate standard for Otto-cycle heavy-duty engines should be the subject of a future action that more thoroughly assessed

[32] Comments from Kelly Brown, Ford Motor Company, to Margo Oge, Director OMS, U.S. EPA, September 9, 1996, Docket A–95–27, IV–D–26.

[33] Section 202(a)(3)(A) of the Clean Air Act specifies that 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.''

[34] Note that the text here is a brief assessment of the information EPA had available at the time a decision was made to refrain from finalizing heavy-duty Otto-cycle standards. However, today's proposal, and the accompanying analysis of feasibility in the RIA, uses more recent data.

[35] All of the vehicles and standards listed are categorized MDV3 in the medium duty vehicle program which includes vehicles with test weights between 5,751–8,500. Test weight is the average of the curb weight and gross vehicle weight.

whether a more stringent standard might be achievable and appropriate for some or all categories of Otto-cycle heavy-duty engines.

D. Consent Decrees With Heavy-Duty Diesel Engine Manufacturers

The Department of Justice and EPA recently filed proposed consent decrees with seven of the largest heavy-duty diesel engine manufacturers in the U.S. in order to resolve the problems uncovered from current and past heavy-duty diesel engines which the government does not believe meet existing standards and defeat device rules. (*See* 63 FR 59330–59334; November 3, 1998). In these consent decrees with the Federal Government these manufacturers have agreed, among other things, to meet a 2.5g/bhp-hr limit on NMHC+NO_X no later than October 1, 2002. The majority of these engine manufacturers have also agreed to produce engines by October 1, 2002 which meet a 1.25 not-to-exceed limit, a 1.0 Euro III limit (on which the Agency's proposed supplemental steady-state cycle is based), and to test engines over and eventually comply with a load response test and limit.[36] The fact that these engine manufacturers have agreed to meet the 2004 standards in 2002 gives the Agency additional confidence that the NMHC+NO_X standard being reaffirmed in today's proposal is appropriate for the 2004 model year. Other elements of these consent decrees that are carried over to today's proposed rule include the addition of a new steady state certification test and a new ''not-to-exceed'' (NTE) approach to in-use testing. In addition, under the consent decrees the manufacturers are required to invest considerable resources to evaluate instrumentation and methodologies for on-road testing, providing an additional basis for EPA's expectations regarding the advancement of technology in this area.

The Agency believes these consent decrees will partially address the emission problems from these previously produced engines. However, we do not believe that relying on the current compliance program and the use of enforcement actions in the future is the most appropriate method to assure in-use compliance of heavy-duty engines under all operating conditions. We estimate that the more than 1,000,000 engines at issue in these consent decrees produced since 1988 will have resulted in excess NO_X emissions of more than 15 million tons over the lifetime of the engines, with an estimated 1.3 million excess tons of NO_X being emitted in 1998 alone. This level of NO_X emissions is enormous. To put this in perspective, the Agency's National Air Pollutant Emission Trends report for 1900–1996 estimates the total U.S. emission inventory for annual NO_X emissions was 23.3 million tons. These estimates do not include the previously unknown excess NO_X emissions from on-highway heavy-duty diesels. Assuming the total 1998 national NO_X emissions are similar to 1996, the 1.3 million tons excess NO_X emissions from heavy-duty diesels in 1998 represent approximately five percent of the national total. We believe the new compliance requirements proposed in this NPRM must be put in place in order to assure that the public's health and welfare are protected from these types of excess emissions in the future.

IV. What Are the Details of This Proposal?

A. Reaffirmation of 2004 NMHC + NO_X Standard for Heavy-Duty Diesel Engines

In today's proposal, the Agency is reaffirming the technological feasibility, cost-effectiveness, and appropriateness under the Clean Air Act of the 2004 NMHC+NO_X standard for HDDEs, including the appropriateness of the current 0.1g/bhp-hr PM standard. In 1997, the Agency finalized on-highway heavy-duty diesel standards for model year 2004 of:

2.4 g/bhp-hr NMHC + NO_X

or

2.5 g/bhp NMHC + NO_X with a limit of 0.5 g/bhp-hr on NMHC

For today's proposal, the Agency has conducted a thorough analysis of information and data which has become available since the finalization of these standards in October of 1997. As discussed elsewhere in this preamble and in the RIA for this proposal, manufacturers have made significant progress toward meeting the 2004 standards, and in fact, the Agency believes a large number of manufacturers will be meeting the 2004 model year standards by the end of 2002. Manufacturers have made significant progress in several key technologies for HD diesels which will allow them to meet the 2004 NMHC+NO_X standards. These areas included advanced fuel injection systems, EGR, advanced turbocharger systems, and advanced electronic controls. In the relatively short time frame since the finalization of the 1997 rule, manufacturers have either announced or begun to introduce second generation electronically controlled fuel injection systems, such as the Cummins Accumulator Pump system (CAPS), and the Navistar/Caterpillar second generation hydraulicly actuated electronic unit injections (HEUI) and mechanically actuated electronic unit injection (MEUI) systems.[37 38 39 40 41] These newer systems provide manufacturers with enormous capabilities to tailor-fit engine injection pressures, injection rate shaping, and pilot injection (or multiple pilot injections) to lower NO_X emissions while still complying with the current PM standard, and maintaining or improving upon the fuel efficiency, performance, and durability expected by HDDE users. These advanced fuel systems will be coupled with new, sophisticated EGR systems. As discussed in the RIA, considerable research has been done in the last few years on the application of EGR to heavy-duty diesels in order to meet the 2004 standards. Based on this relatively recent information, it now appears manufacturers will use a combination of hot and cooled EGR, sometimes at relatively high EGR flow rates, on the order of 40–50 percent under certain operating conditions, to achieve the 2004 NMHC+NO_X standards. The Agency believes EGR is perhaps the single most significant advance in emission control technology for HD diesels which will enable the approximately 50 percent reduction in NO_X emissions required by the 2004 standards. As discussed in the draft RIA, cooled EGR is very effective at reducing NO_X emissions. Laboratory studies have shown that EGR can reduce NO_X emissions by up to 90 percent at

---

[36] The Consent Decrees establish target limits for a load response test of 1.3 times the federal test procedure (FTP) standard for NMHC+NO_X and 1.7 times the FTP standard for PM. These limits would take effect for affected manufacturers after October 1, 2002. However, the Consent Decrees establish a process to determine whether these limits should be modified to ensure that they are the lowest achievable given the technology available at the time. Under this process, manufacturers would submit load response test data with their certification applications starting with the 1999 model year, and by October 1, 2000, the parties to the Consent Decrees would review these data to determine appropriate emission limits.

[37] SAE paper 973182, ''Advanced Technology Fuel System for Heavy-duty Diesel Engines''.

[38] *Diesel Progress,* August 1998, ''CAT Gears Up Next Generation Fuel Systems'', available in EPA Air Docket A–98–32, Docket Item #II–D–03.

[39] *Diesel Progress,* August 1998, ''Next Generation MEUI–B to Debut in 2001'', available in EPA Air Docket A–98–32, Docket Item #II–D–03.

[40] *Diesel Progress,* October 1998, ''No Mistaking New Cummins ISL Engine'', available in EPA Air Docket A–98–32, Docket Item #II–D–04.

[41] ''Cummins New Midrange Fuel System'', presented by John Youngblood, Cummins Engine Company, at the SAE Diesel Technology TOPTEC, April 22, 1998, available in EPA Air Docket A–98–32, Docket Item #II–D–01.

light load and up to 60 percent at full load near rated speed.[42] Other studies have shown similar reductions at other speeds and loads.[43] In addition to fuel system changes and EGR, turbocharger manufacturers and engine manufacturers are in the process of developing new variable nozzle turbochargers (VNT, sometimes referred to as variable geometry turbochargers), as well as more advanced, electronically controlled wastegated turbochargers, for both performance and emission reasons. The new VNT systems will allow manufacturers more flexibility in how they design their EGR systems, and provide improved performance for engine users. Finally, engine manufacturers continue to develop and introduce highly sophisticated electronic control management systems based on the latest microprocessor technology available.[44] These next generation control systems integrate the complete engine/powertrain system, including the injection system, EGR, and turbocharger, which allows the manufacturer to maximize the engine performance as well as emission control system. The RIA for this proposal provides additional detail on these technologies, as well as the Agency's cost analysis for the combination of technologies which EPA expects will be used to meet the 2004 NMHC+NO_X standards. Based on the most recent information available, the Agency is confident that engine manufacturers are making sufficient progress in the development of technologies which will allow them to meet the 2004 NMHC+NO_X standards. As discussed below, the Agency does not believe changes in diesel fuel quality are needed for engines to meet these standards.

In addition, as noted in section III.D, the fact that several heavy-duty diesel engine manufacturers have agreed to meet the 2004 standards in 2002 gives the Agency additional confidence that the NMHC+NO_X standard being reaffirmed in today's proposal is appropriate for the 2004 model year.

As discussed in section IX, and in the draft RIA, EPA does not believe more stringent standards for the 2004 model year are technologically feasible, giving appropriate consideration to cost, energy, and safety factors. Technologies which could reduce emissions significantly below the 2004 standards, such as NO_X absorber catalysts, are still in the research and development stage, and do not appear to be ready for the 2004 model year. The Agency has also examined technologies to reduce PM from HD diesel engines, including diesel oxidation catalysts and particulate traps. As discussed in the draft RIA, we believe the current PM standard of 0.1 g/bhp-hr (0.05 for urban buses) continues to be the appropriate standard for the 2004 time frame. However, in section X of today's proposal we discuss the possible feasibility of more stringent standards in later model years, although no specific proposals are made today.

B. Are Changes in Diesel Fuel Quality Necessary To Meet the 2004 Standards?

The purpose of this section is to assess the current understanding of the role diesel fuel quality plays in the ability of diesel engines to meet the 2004 NMHC+NO_X emission standards and to determine whether these standards can be met using currently available fuel. It has long been realized that diesel engine technology alone is not the only mechanism to lower NO_X emissions. Diesel fuel quality also plays an important role in emission formation, as well as engine performance. In addition, diesel fuel quality can play a role in the effectiveness of certain emission control technologies, and in some cases can be considered a technology enabler, i.e., some emission control devices may not function because of certain diesel fuel properties, such as sulfur content. In EPA's 1997 final rulemaking for the 2004 standards, we stated that we believed the 2004 standards were appropriate and technologically feasible through diesel engine technology modifications alone, without changes to diesel fuel quality (*see* 62 FR 54700, Oct. 21, 1997). However, we also stated that this issue would be revisited in the 1999 technology review rulemaking. ''EPA will evaluate in light of any new information whether diesel fuel improvements are needed for the standards to be appropriate for 2004.'' (*See* 62 FR 54700, Oct. 21, 1997).

Section V.A. of this preamble (''2004 Emission Standards for Heavy-duty Diesel Engines'') and Chapter 3 of the draft RIA for this proposal (''Technological Feasibility of HD Diesel and Otto-cycle Standards'') discuss in detail the technologies we believe will enable HD diesel engines to meet the 2004 standards, on existing U.S. HD diesel fuel. These technologies include cooled EGR, advanced fuel injection systems with rate-shaping ability, advanced turbocharger designs (such as variable nozzle turbochargers), and electronic engine management. These technologies have been demonstrated to produce significant emission reduction, independent of changes in current U.S. diesel fuel quality. Based on the information discussed in section V.A. of this preamble and Chapter 3 of the draft RIA, and based on the fact that these emission control technologies can produce substantial emission reductions using current diesel fuel, we conclude no change in diesel fuel quality is necessary to meet the 2004 NMHC+NO_X standard. We request comment on this conclusion, and encourage commenters to supply any data and information that may support their comments.

Engine manufacturers have recently raised concerns to EPA regarding the potential negative effects of current diesel fuel sulfur levels on engine durability for 2004 technology engines for the full useful life of the engines. As discussed in Chapter 3 of the draft RIA for this rule, the use of cooled EGR systems to meet the 2004 standards can give rise to potentially significant concentrations of sulfuric acid formation in the recirculated exhaust if the EGR system cools the exhaust below the water vapor dew point. In addition, some HD diesel engine manufacturers have expressed specific concern regarding the extended useful life for the heavy-heavy duty diesel service class which goes into effect in 2004. In the 1997 final rulemaking for on-highway heavy-duty diesel engines, EPA revised and extended the useful life for the heavy-heavy service class from 290,000 miles to 435,000 miles (*see* 62 FR 54700, October 21, 1997). Several manufacturers have suggested EPA should reconsider this useful life extension due to their concerns with engine durability, diesel fuel sulfur, and cooled EGR systems. These manufacturers have suggested EPA implement the extended useful life contingent upon federal diesel fuel standards meeting some threshold maximum fuel sulfur content. However, the Agency believes manufacturers will design cooled EGR systems to limit sulfuric acid formation and to prevent in-use durability problems. As

[42] Dickey D.W., T.W. Ryan III, A.C. Matheaus: ''NO_X Control in Heavy-Duty Engines-What is the Limit?'', SAE paper 980174, 1998. Dickey; and, Zelenka P., H. Aufinger, W. Reczek, W. Cartellieri: ''Cooled EGR–A Key Technology for Future Efficient HD Diesels,'' SAE paper 980190, 1998.

[43] Kohketsu S., K. Mori, K. Sakai, T. Hakozaki: EGR Technologies for a Turbocharged and Intercooled Heavy-Duty Diesel Engine,'' SAE paper 970340, 1997; Baert R., D.E. Beckman, A.W.M.J. Veen: ''EGR Technology for Lowest Emissions,'' SAE paper 964112, 1996; and, Heavy-duty Engine Working Group, Mobile Source Technical Advisory Subcommittee of the Clean Air Act Advisory Committee, ''Phase 2 of the EPA HDEWG Program—Summary Document'', available in EPA Air Docket A–98–32.

[44] See for example SAE paper 981035, ''The Cummins Signature 600 Heavy-Duty Diesel Engine'' T.R. Stover, D.H. Reichenbach, and E.K. Lifferth, Cummins Engine Co., Inc., Feb., 1998.

discussed in the RIA (section 3.II.B), EPA expects engine manufacturers to maintain EGR cooler systems slightly above the water vapor dew point, particularly at high load. In addition, EPA expects manufacturers to utilize EGR systems made of sulfuric acid corrosive resistant materials (such as specially treated stainless steel) to prevent deterioration of the EGR system. We request additional information and supporting data on the manufacturers' concerns regarding durability issues associated with the 2004 standards. We request specific comment and supporting data on the manufacturers' concerns, including any in-use or laboratory durability data, and any data which would support or refute the manufacturers' contentions regarding the need for a shorter useful life for the heavy-heavy service class.

In the remainder of this section, we review the new information which has become available since the 1997 rulemaking through a study performed by the Heavy-duty Engine Working Group.

In anticipation of the need for new information regarding the influence of diesel fuel quality on future emission technologies and achievable levels, in December of 1995 a new Working Group called the Heavy-duty Engine Working Group (HDEWG) was formed under the Mobile Source Technical Advisory Subcommittee of the Clean Air Act Advisory Committee. The HDEWG consists of approximately 30 members, including representatives from EPA, heavy-duty engine original equipment manufacturers (OEMs), the oil industry, state air quality agencies, private consultants and members of academic institutions. The HDEWG formed a steering committee which consisted of representatives from EPA, Cummins, Caterpillar, Navistar, Ford, British Petroleum, Equilon, Mobil Oil, Phillips, the Engine Manufacturers Association, the American Petroleum Institute, and the National Petroleum Refinery Association. The HDEWG set as their research objective to contribute to EPA's 1999 technology review of the $NMHC+NO_X$ emission standards for model year 2004 heavy-duty diesel engines by assessing relative merits of achieving 2.5 g/bhp-hr $NMHC+NO_X$ level either through engine system modifications alone, or a combination of engine system and fuel modifications.

The HDEWG established a three phase process in order to meet their objective. In Phase 1, the goal was to determine whether the combined effects of diesel fuel properties on exhaust emissions of "black box",[45] advanced prototype engines being developed by engine manufacturers were large enough to warrant a Phase 2. However, the details of each black box engine would not be shared with the HDEWG. In addition, the HDEWG agreed to use one "transparent" engine at an independent test facility, Southwest Research Institute (SwRI). During Phase 1, testing was to be performed on the transparent engine at SwRI, as well as the black box engines at manufacturers' own testing facilities, to determine if the transparent engine was representative of the black box engines with respect to diesel fuel effects on NO_X emissions. Phase 2 of the program, which would occur upon successful completion of Phase 1, would be used to test a range of relevant fuel properties on the transparent engine at SwRI, in order to determine the effects of various fuel properties on emissions. Finally, Phase 3 of the test program would determine whether or not the results seen during Phase 2 on the transparent engine was in fact representative of black box engines, i.e., advanced prototype engines being developed by engine manufacturers to meet the 2004 standards. Phase 3 would be performed at engine manufacturers' laboratories using a subset of the fuel matrix from Phase 2.

At the time of the publication of this proposal, Phase 1 and Phase 2 of the program have been completed. Phase 3 is expected to be completed by the end of 1999. The RIA for this proposal contains a detailed discussion of the Phase 1 and Phase 2 portions of the HDEWG test program. The reader should see Chapter 3 of the draft RIA for this proposal for a detailed description.

The HDEWG's primary focus was on the effects of diesel fuel properties on HC and NO_X emissions, not on PM emissions, and therefore fuel sulfur level was not investigated. A significant amount of data exists on the effects of diesel fuel sulfur on engine emissions, and in fact this data was summarized recently in a paper published by members of the HDEWG.[46] Existing data on recent model year HD engines indicates diesel fuel sulfur level does have a statistically significant effect on PM emissions, but no statistically significant effect on HC, carbon monoxide (CO), or NO_X emissions for engines with no exhaust aftertreatment. For this reason, and because of the focus on NMHC and NO_X emissions, as well as the limitations of the prototype SwRI transparent engine, the HDEWG did not include fuel sulfur level as a variable in Phase 1, 2 or 3 of their test program, nor were PM emissions measured during Phase 1 or 2. The Phase 3 test program, done at individual engine manufacturers' facilities, will include PM measurement.

The HDEWG concluded two points based on the results of the Phase 1 testing. First, initial testing on a limited set of diesel fuel formulations (fuel batches with high cetane number and low aromatics) on advanced prototype engines by the engine manufacturers showed a change in NO_X emissions which warranted additional testing under Phase 2. Second, the "transparent" engine at SwRI performed in a way that was representative of engine manufacturers' advanced prototypes, and was therefore an adequate test engine for Phase 2.

The purpose of the Phase 2 component of the test program was to test a range of relevant fuel properties on the transparent engine at SwRI in order to determine the effects of various fuel properties on emissions. All testing during Phase 2 of the test program was done at SwRI on the transparent engine. Based on the results of the Phase 1 testing, as well as the literature review performed under Phase 1, the HDEWG selected four fuel properties for investigation under Phase 2: density, cetane (natural and "boosted"[47]), monoaromatic content and polyaromatic content. As mentioned previously, fuel sulfur level was not investigated. A test matrix was designed to decouple these fuel properties from each other. The design matrix included two levels of density, monoaromatic hydrocarbons, polyaromatic hydrocarbons, and three levels of cetane, with duplicate test points for both natural and "boosted" cetane. The final matrix included eighteen test fuels, with density varying from 830 to 860 kg/m^3, cetane numbers from 42 to 48 to 53, monoaromatic content from 10 to 25 percent, and polyaromatic content from 2.5 to 10 percent. The test cycle used by SwRI was the AVL 8-mode test. This steady-state test cycle, with associated weighting factors, has been shown in the past to correlate very well with NO_X emissions measured over the U.S. heavy-duty federal test procedure (FTP). All emission tests were performed at least in duplicate. The transparent engine used a SwRI is a modern, heavy-heavy duty diesel engine with

[45] "Black box" engines are advanced engines being designed by engine manufacturers to meet the 2004 standards.

[46] *See* Lee, R., Pedley, J., and Hobbs, C., "Fuel Quality Impact On Heavy-Duty Diesel Emissions:—A Literature Review", Society of Automotive Engineers paper number 982649, 1998.

[47] Boosted cetane is achieved by the addition of a fuel additive, in this case ethylhexyl nitrate.

electronically controlled unit injectors capable of meeting the U.S. 1998 model year emission standards. This engine was modified by SwRI with the addition of a prototype, low-pressure loop, cooled EGR system with manual control of EGR flow rates. For the Phase 2 test program, SwRI selected EGR rates necessary to approach an AVL 8-mode composite NO_X level of 2.5g/hp-hr.

The large quantity of test data generated by the test program was evaluated using statistical techniques in order to develop exhaust emission and fuel consumption prediction models based on the four fuel properties. All properties were evaluated using a significance level of five percent. The data generated during Phase 2 indicates that for engines utilizing advanced fuel injection and a cooled EGR system operating at emissions levels near the 2004 standards the effects of large changes in individual fuel properties on $HC+NO_X$ emissions are rather small, and for cetane number not statistically significant. A large decrease in fuel density, from 860 to 830 kg/m^3, or in monoaromatic content, from 25 to 10 percent, is predicted to result in a 4.3 percent decrease in $HC+NO_X$ emissions. A large decrease in polyaromatics content, from 10 to 2.5 percent, is predicted to result in a 2.3 percent decrease in $HC+NO_X$ emissions.

The Phase 2 data was also analyzed to predict the combined effects from diesel fuel changes on emissions, not just single property changes. The Phase 2 model was used to predict the effect of fuel modifications from current, average U.S. on-highway diesel fuel to a ''cleaner'', reformulated diesel fuel, one with low density (830 kg/m^3), high cetane (52), low monoaromatics (10 percent), and low polyaromatics (2.5 percent). The Phase 2 model predicts this significant change in U.S. diesel fuel formulation would result in a 8.4 percent decrease in $HC+NO_X$ emissions.

The Phase 3 results are currently not available. However, based on what has been seen in the Phase 1 and Phase 2 portions of this test program, we do not believe a change in diesel fuel formulation is required to make the 2004 model year $NMHC+NO_X$ standards technologically feasible and appropriate under the CAA. The data from the Phase 1 and 2 portions of the HDEWG does indicate that a change in diesel fuel formulation could provide for a small reduction in $HC+NO_X$ emissions from HD diesels, on the order of an 8 percent reduction. An assessment of the appropriateness of such a diesel fuel reformulation, beyond the 2004 standards with existing HD diesel fuel, is outside the scope of this rulemaking.

C. Otto-Cycle Engine-Based Program

We are proposing an $NMHC+NO_X$ standard for Otto-cycle engines for 2004 and later model years, but are limiting the applicability of this new standard to engines used in vehicles over 14,000 pounds GVWR and in incomplete vehicles.[48] (We are also proposing new vehicle standards for the remaining engines, as discussed in later sections.) We are not proposing to apply the vehicle standards to these engines at this time. Engines used in incomplete vehicles are manufactured for use in many different kinds of heavy-duty vehicles by many different manufacturers. Vehicles in the weight categories above 14,000 pounds GVWR tend to be quite large and varied compared to pick-up trucks and full-size vans, and most dynamometer test facilities are currently not equipped to accommodate vehicles in this size range. Additionally, this approach is consistent with California which allows engine-based testing for these vehicles in its Medium-duty Vehicle program.

1. Engine Exhaust Emissions Standards

We propose a $NMHC+NO_X$ standard of 1.0 g/bhp-hr for MY 2004 and later for those Otto-cycle engines in the engine-based program. The proposed standard represents a reduction in the NO_X and HC standards of over 75 percent. EPA believes that this standard represents the most stringent standard reasonably achievable for these engines, in keeping with the requirements of the CAA. EPA's analysis of the technological feasibility of a 1.0 g/bhp-hr $NMHC+NO_X$ standard is contained in Technological Feasibility section below. We also believe that the ABT program proposed for engines provides manufacturers with the needed flexibility to meet the new standard as their product lines become subject to the new engine standards. The ABT provisions are also described below. In their assessment of the feasibility of new engine-based standards, engine manufacturers recommended a standard of 2.0 g/bhp-hr $NMHC+NO_X$. The Technological Feasibility section also contains a discussion of the manufacturer's recommendations. EPA requests specific comment on a range of possible standards, from the proposed standard of 1.0 g/bhp-hr to 1.5 g/bhp-hr, and on the standard of 2.0 g/bhp-hr proposed by engine manufacturers.

[48] Incomplete vehicles less than 14,000 lbs GVWR could optionally certify to the proposed new vehicle standards, as discussed in a later section.

2. Averaging, Banking, and Trading for Otto-Cycle Engines

As part of proposing more stringent engine-based standards, EPA is proposing a modified ABT program for these engines. The program is similar in design to the program adopted for diesel engines. EPA is proposing ABT modifications to allow more flexibility within the ABT framework to help meet the more stringent standards. ABT credits can help manufacturers with engine configurations that are more difficult to modify, where more time would help reduce costs. Credits can also allow manufacturers to continue with product plans that might call for the retirement of an engine family at some point shortly after 2004. By banking credits manufacturers can also reduce their uncertainty or risk associated with the new standards. In the Summary and Analysis of Comments for the Diesel Final Rule, EPA explained why the modified ABT program adopted in that rulemaking will not decrease emissions reductions associated with the new standards.[49] Similarly, EPA believes that the modified ABT program proposed in this rulemaking also will not decrease emissions reductions associated with the new standards.

The ABT program has been used for only one Otto-cycle engine family to meet the current 4.0 g/bhp-hr NO_X standard which went into effect in the 1998 model year. In other cases, advances in catalyst technology and engine/fuel system improvements have allowed manufacturers to meet the standard across their product line. Most engine families have certification levels of less than half the standard. However, with the proposed standard for 2004, EPA expects ABT to become a more important tool for Otto-cycle engine manufacturers.

An ABT program allows the Agency to propose and finalize a more stringent engine standard than might otherwise be appropriate under the CAA, since ABT reduces the cost and improves the technological feasibility of achieving the standard. EPA is proposing changes to the ABT program with the intent that the changes would enhance the technological feasibility and cost-effectiveness of the new standard, and thereby help to ensure the new standard would be attainable earlier than would otherwise be possible. The changes would provide manufacturers with additional product planning flexibility and the opportunity for a more cost effective introduction of product lines

[49] See EPA Air Docket No. A–95–27.

meeting the new standard. Also, EPA believes that ABT creates an incentive for early introduction of new technology which allows certain engine families to act as trail blazers for new technology. This can help provide valuable information to manufacturers on the technology prior to manufacturers needing to apply the technology throughout their product line. This further improves the feasibility of achieving the standard. This early introduction can also provide valuable information for use in other regulatory programs that may benefit from similar technologies (e.g., nonroad programs). EPA views the effect of the ABT program itself as environmentally neutral because the use of credits by some engines is offset by the generation of credits by other engines. However, when coupled with the new standards, the ABT program would be environmentally beneficial because it would allow the new standards to be implemented earlier than would otherwise be appropriate under the Act.

EPA proposes the following provisions for the modified ABT program for Otto-cycle engines:

- Manufacturers could bank NO_X credits beginning in MY 2000 for MYs 2004 and later.
- Credits would be earned up to a NO_X level of 2.0 g/bhp-hr.
- Credits would be discounted by 10 percent for engine families with FELs above the 1.0 g/bhp-hr NMHC+NO_X level (i.e., the proposed standard) and undiscounted for engine families with FELs at or below the 1.0 g cut point.
- For model year 2004 and later, engine families with FELs above 0.5 g/bhp-hr NMHC+NO_X (i.e., one-half of the proposed standard) would be discounted by 10 percent. Engine families with FELs at or below 0.5 g/bhp-hr would earn undiscounted credits.
- As with the diesel program, NO_X credits banked prior to 2004 would be used to meet the combined NMHC+NO_X standard in 2004 and later.
- Credits banked under the modified program would have unlimited credit life.
- Engine families using credits after MY 2004 may not exceed the previous NO_X standard of 4.0 g/bhp-hr.
- Engine families generating credits prior to 2004 must meet the revised requirements for deterioration factors noted above.

Prior to 2004, manufacturers could continue to use the current ABT program. EPA proposes that the current program would end in 2004 and the modified program would remain. Only credits banked under the modified program could be used in 2004 and later. EPA is proposing to end the current program with the 2003 model year because of concern that manufacturers could generate enough credits under the current program to significantly delay the 2004 standards. The current program allows manufacturers to earn credits up to the current NO_X standard of 4.0 g/bhp-hr. With most engines currently certified with NO_X levels below 2.0 g/bhp-hr, there is potential for substantial credit generation without the application of improved technology under the current ABT program. If manufacturers were to bank these credits, they could potentially use them to delay the introduction of engines meeting the 2004 standards for a large majority of their sales for up to three years. The proposed 2.0 g/bhp-hr ceiling for credit generation in the modified program provides opportunity for manufacturers to earn credits through the use of emissions controls that are superior to the average controls currently being used. EPA believes this approach is consistent with the goals of ABT. EPA requests comment on the proposed 2.0 g/bhp-hr ceiling and on other alternatives for transitioning from the current 4.0 g/bhp-hr NO_X standard to the 1.0 g/bhp-hr NO_X standard proposed for 2004. One such alternative could be a phase down of the credit generation trigger value during the model years prior to 2004, rather than a single trigger point of 2.0 g/bhp-hr.

The changes to credit life and discounting being proposed for Otto-cycle engines are conceptually consistent with the modifications finalized for diesel engines. EPA is proposing to discount credits by 10 percent if the engine has an FEL above a certain value or cut-point. EPA adopted cut points in the diesel program in order to identify the introduction of new technology as opposed to recalibrating or enhancing existing technology. EPA believes that adoption of cutpoints in the HD Otto-cycle engine program will provide similar technology forcing incentives. EPA selected cut-point levels which represent a clear step in emissions control rather than a marginal emissions reduction. The 10 percent discount selected for the HD Otto-cycle engine ABT program is consistent with the program finalized for diesel engines. In that final rule, EPA noted that a 10 percent discount strikes a balance between zero (which significantly reduces the incentive to develop and implement significantly cleaner technology) and 20 percent (which manufacturers indicated in comments was far too large and would create a disincentive for the introduction of cleaner technology). (*See* 62 FR 54708, October 21, 1997.) EPA requests comment on the selected levels of the cut-points and discount adjustment, including comments on whether a phased-in approach with a decreasing cut-point would be appropriate for this category of engines.

For diesels, EPA removed the three year credit life limit which allows manufacturers to earn credits to be used in 2004 and later as early as the 1998 model year. For Otto-cycle engines, MY 2000 will be the earliest model year in which the rule would be effective due to the timing of the rulemaking. Removing the credit life limit will provide an additional year of potential credit banking and allows manufacturers to retain credits after 2004 rather than having them expire after a certain year. We believe that having credits expire would simply encourage manufacturers to use the credits rather than save them; thus, removing the credit life limit should provide a net environmental benefit.[50]

We believe that our proposals detailed above for a modified ABT program will encourage the early use of cleaner technologies and provide manufacturers with valuable flexibility in transitioning to more stringent standards. EPA is proposing the modification to the ABT program in conjunction with the 1.0 g/bhp-hr NMHC+NO_X engine-based standards to provide the flexibility necessary to enable manufacturers to meet the standard across their product line. This flexibility may not be necessary in the context of a less stringent standard, in which case the proposed modifications to the ABT program might not be supportable. EPA requests comments on all aspects of the proposed ABT program.

D. Supplemental Exhaust Emission Standards and Test Procedures for HD Diesel Engines

1. Introduction/Background

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

[50] EPA presented a detailed analysis of its ABT program in the Summary and Analysis of Comments for the Diesel Final Rule, Docket A–95–27, document No. V–C–01.

belief that the engines would be meeting the standards in-use under typical operating conditions. The supplemental provisions we are proposing today for HD diesel engines are intended to help ensure this is the case. Today's proposal includes a new set of supplemental emission standards and associated test procedures to more closely represent the range of real world driving conditions.

EPA believes that an important tool for achieving an effective compliance program is an in-use program with an objective standard and easily implemented test procedure. Today's action does not include a proposal for a manufacturer in-use testing program for HD diesels and HD Otto-cycle engines. However, as discussed in section V, EPA believes a manufacturer in-use testing program is a critical component of a comprehensive compliance program, and EPA intends to work with interested parties towards the development of a proposal for an in-use testing program in the near future. We believe that the combination of supplemental standards and an effective in-use testing program will ensure that the environmental benefits resulting from the emission standards for model year 2004 and beyond will be achieved in-use.

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 (i.e., heavy-duty diesel engines, heavy-duty Otto-cycle engines used in incomplete vehicles, and heavy-duty Otto-cycle engines used in vehicles with a GVWR greater than 14,000 pounds). 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 current focus on a standardized test procedure makes it harder 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 are designed to supplement the current FTP standards and defeat device prohibition, and help ensure that the standards are providing the intended benefits in actual use.

The Agency also believes a supplemental standard and test procedure or an alternative mechanism is needed for HD Otto-cycle engines used in incomplete vehicles, and heavy-duty Otto-cycle engines used in vehicles with a GVWR greater than 14,000 pounds, in order to assure in-use compliance over a broad range of operating conditions. Today's proposal does not include supplemental standards for test procedures for this class of engines because more information is needed to allow determination of appropriate emission levels and resolution of other specific technical issues. As discussed in section V, the Agency intends to gather further information related to the appropriate levels and scope of such standards over the next several months and to release a subsequent proposal within the next year which would include supplemental standards and test procedures for HD Otto-cycle engines.

In the Statement of Principles,[51] signed by EPA, the California Air Resources Board and engine manufacturers, the signatories agreed to develop appropriate measures which ensure that emission controls are maintained throughout the engine's life. During the public comment period for the proposed 2004 standards for diesel heavy duty engines, several state and environmental organizations advocated establishing an in-use compliance program. (*See* 62 FR 54707–54708; October 21, 1997). Commenters urged EPA to develop an effective in-use compliance program to ensure that heavy-duty engines comply with emission standards over their useful lives. We also received comment that the current federal test procedure (FTP) does not reflect realistic driving conditions (for example, high speeds and loads), and that a more representative test cycle is needed. We acknowledged that it was essential to further understand in-use emissions and establish a comprehensive in-use compliance presence.

In the October 1997 final rule, EPA adopted a number of measures designed to improve in-use compliance for heavy-duty diesel engines. (*See* 62 FR 54700–54702; October 21, 1997). In summary, these measures included: (1) Extending the engines' useful life; (2) increasing the maintenance intervals for emissions-related components; (3) strengthening the warranty provisions for emissions defects and emission performance; (4) requiring that manufacturers provide owners with guidance on maintenance for emissions-related components and on responding to emission-related codes from on-board diagnostic systems; and (5) strengthening ''anti-tampering'' requirements for engine rebuilding. We also committed to further review and revise the compliance programs if needed to ensure that the emission reductions from more stringent standards are realized in-use. Since then, we have learned that many heavy-duty engines currently are not meeting emission standards in-use. EPA recently issued enforcement policy guidance to partially address this problem.[52]

2. Proposed Supplemental Test Procedures and Standards

We propose to add two supplemental sets of standards and test requirements for HD diesel engines: (1) A supplemental steady-state test and accompanying standards; and (2) Not-To-Exceed Limits. Like current standards, these new standards would apply to certification, production line testing, and vehicles in actual use. All existing provisions regarding standards (e.g., warranty, certification, recall) would be applicable to these new standards as well. The steady-state test is proposed because it represents a significant portion of in-use operation of heavy-duty diesel engines that is not adequately represented by the FTP. In addition, we are proposing a third supplemental test procedure for heavy-duty diesel engines—a Load Response Test—as a data submittal requirement only; we do not propose emission limits for this test procedure at this time. The proposed Load Response Test also represents operation not adequately represented by the current FTP (harder accelerations), and could eventually be used to ensure effective control of NO_X and PM during this type of operation. The combination of these supplemental test requirements and emission standards would provide assurance that engine emissions are designed to achieve the expected level of in-use emissions control over all expected operating regimes in-use. These test procedures and emission limits are

[51] For more background on the Statement of Principles, see section III.A. of this preamble.

[52] Available in the public docket for review.

described in greater detail in the following sections.

We believe that to ensure that emission standards actually achieve their intended environmental benefits, the emissions measured during engine test procedures must be indicative of emissions released during real world operation. Recent advances in engine technology have created the opportunity for a broader gap to exist between typical real world operating conditions and those conditions represented by the current EPA test cycle. The inconsistencies between lab and real world emissions reduce the certainty that emission standards will achieve their intended benefits. One approach to address this is enforcing compliance with the current regulations, including the defeat device prohibition, on a case-by-case basis. However, as discussed previously, given the potential magnitude of the emission impact, we believe it is more appropriate to address this concern through expanding the test procedures and related emission standards.

As discussed in more detail in the following sections, each of these supplemental proposed emission standards is expressed as a multiple of the existing FTP emission standards, or Family Emission Limit (FEL) if the engine is certified under the ABT program, whichever is applicable. For example, the diesel engine NTE limit for NO_X + NMHC is 1.25 times the current FTP emission standard, or 1.25 times the applicable FEL. When certifying engines under the ABT program, manufacturers must ensure that the FEL is set sufficiently high so that all of the new proposed emission standards will be met in-use. For example, there may be cases where the FTP and supplemental steady-state emission result is well below the standard, but setting the FEL is constrained by the Not-To-Exceed emission result.

For purposes of certification, actual test data for the steady state test and the Load Response Test would have to be submitted as part of the certification application (although only the steady state test data would require comparison to proposed emission limits). The Not-to-Exceed test limits would require only a statement of compliance at certification (with supporting details). The compliance statement would need to state explicitly that the engine will comply with the applicable NTE limits when operated under all conditions which may reasonably be expected to be encountered in normal vehicle operation and use. However, this statement must be founded upon emission test data, additional technical information, and good engineering judgement. The manufacturer's basis for making the compliance statement would be explained within the certificate application documentation, and the supporting information would be available for review by the Agency.

a. Supplemental Steady-State Test

We propose to add a steady-state test cycle to the current Federal test procedures for HD diesel engines. The proposed steady-state test cycle is consistent with the test cycle found in the European's ''EURO III ESC Test''; however not all aspects of the proposed supplemental steady-state test are identical to the EURO III ESC Test.[53] Manufacturers would be required to meet the standards under this test cycle as well as continuing to meet the standards using the current test procedure (including the current transient test cycle) in 40 CFR part 86, subpart N.[54] The proposed supplemental steady-state test cycle is needed so that the FTP reflects a greater range of driving conditions experienced on the road. The current FTP does not fully represent the driving patterns of today's heavy-duty diesel vehicles, nor does it fully take into account the increased use of electronic engine management systems. These electronic systems have the ability to optimize fuel economy during real-world driving, but often at the expense of emissions. The proposed steady-state test cycle represents an important type of modern engine operation, in power and speed ranges that are typically used in practice. The mid-speeds and mid-to-high loads represented by the proposed steady-state test are the speeds and loads that these engines are designed to operate at for maximum efficiency and durability. Specifically, highway cruise speeds and loads fall into the operation represented by the proposed steady-state test.

The proposed supplemental steady-state test cycle consists of 13 modes of speed and power, covering the typical operating range of heavy-duty diesel engines. The cycle concentrates on the engine speed range bounded by 50 percent and 70 percent of rated power, which is the range most utilized by heavy-duty diesel engines. This speed range is then divided into bands (engine speeds A, B and C, as defined in proposed § 86.1360–2004(c)). The ''control area'' is defined by the area between engine speeds A and C, and between 25 to 100 percent load. During the test cycle, the engine is initially run at idle speed, then through a defined sequence of 12 modes at various speeds and engine loads of 25, 50, 75 and 100 percent. Each mode (except idle) is run for two minutes. During each mode of operation, the concentration of the gaseous pollutants is measured and weighted (according to the weighting factors in proposed § 86.1360–2004(b)(1)). The weighted average emissions for each pollutant, as calculated according to this steady-state test procedure, must not be greater than 1.0 times the applicable 2004 emission standards. (*See* proposed § 86.004–11(a)(3).)

Manufacturers would perform the supplemental steady-state test in the laboratory following all applicable test procedures in 40 CFR part 86, subpart N (*e.g.*, procedures for engine warm-up and exhaust emissions measurement). The test must be conducted with all emission-related engine control variables in the maximum NO_X producing condition which could be encountered for a 30 second or longer averaging period at the given test point.

In addition to the 13 modes of the test cycle, EPA would have the opportunity to select an additional three test points as a check to ensure the effectiveness of the engine's emission controls within the control area (*e.g.*, ensuring that emissions do not ''peak'' outside of the 13-mode test points). This requirement would ensure that an engine achieves emissions control throughout the typical operating range. EPA would notify the manufacturer of these three additional test points prior to the test. During the test, the regulated pollutants would be measured at each of these EPA-selected test points. The manufacturer also would determine an interpolated value of pollutant emissions at each EPA-selected test point, using the measured emissions of the closest four adjacent test points. See the illustration in Figure 2 of proposed § 86.1360–2004(g). EPA proposes a four-point linear interpolation procedure that is consistent with that of the European's ''EURO III'', referenced above. (See proposed § 86.1360–2004(g)(2).) The measured emissions value would then be compared to the interpolated emissions value. The measured pollutant value must not exceed the

[53] ''Draft Proposal for a Directive of the European Parliament and the Council Amending Directive 88/77/EEC of 3 December 1987 on the Approximation of the Laws of the Member States Relating to the Measures to be Taken Against the Emission of Gaseous and Particulate Pollutants from Diesel Engines for Use in Vehicles'', a proposal adopted by the Commission of the European Union on 3 December 1997, for presentation to the European Council and Parliament.

[54] These requirements are consistent with those in the Consent Decrees recently signed with several heavy-duty diesel engine manufacturers. (See 63 FR 59330–59334; November 3, 1998).

interpolated pollutant value by more than five percent. We request comment on the proposed interpolation methodology and on whether five percent is the appropriate value to use for comparison of interpolated values and measured emissions.

The emission levels at the 12 non-idle test points and the calculated emissions values from the four-point interpolation procedure for intermediate test points would establish an emissions ''surface'' of Maximum Allowable Emission Limits (MAELs), as illustrated in Figure 1 of proposed § 86.1360–2004(f). This surface would limit emissions levels during all normal operations, including transient operation, that occur within the control area defined above. Each point on this surface will have a MAEL associated with it for all engines in that engine family.[55] The MAEL for each point is calculated using the same four-point linear interpolation procedure used to determine the emission value for the EPA test points discussed above. For certification, production line and in-use engines, emissions generated within the control area may not exceed the MAEL for the corresponding speed and load point over a thirty second averaging period.

At certification, manufacturers would be responsible for testing the MAELs by performing the ''check'' described above for the three EPA-selected test points. Under its authorities in the Act, EPA could determine compliance with the MAELs under any conditions that may reasonably be expected to be encountered in normal vehicle operation and use, either in the laboratory or in actual use (''on-road''), under steady-state or transient conditions, and under varying ambient conditions. (*See* section IV.D.3 for a discussion of on-road testing). To determine compliance, test results from operation within the control area must comply with the MAEL established for that engine family at the same engine speed and load.

b. Not-To-Exceed Limits

To help ensure that heavy-duty engine emissions are controlled over the full range of speed and load combinations commonly experienced in-use, EPA is proposing to apply Not-To-Exceed (NTE) limits to HDDEs. The NTE approach establishes an area (the ''NTE zone'') under the torque curve of an engine where emissions must not exceed a specified value for any of the regulated pollutants.[56] The NTE standard would apply under any conditions that could reasonably be expected to be seen by that engine in normal vehicle operation and use. In addition, we propose that the whole range of real ambient conditions be included in NTE testing. The proposed NTE zones, limits, and ambient conditions and test procedures for HDDEs and HDGEs are described below. These requirements would take effect starting in the 2004 model year and would apply to new engines as well as in use throughout the useful life of the engine. We request comment on expanding the range of ambient conditions in this manner and on whether this expanded range is appropriate to begin with the 2004 model year, or whether a phased in approach is more appropriate.

In addition to helping to ensure emission benefits over the full range of in-use operating conditions, the NTE requirements are also expected to be an effective element of an in-use testing program. At the time of certification manufacturers would have to submit a statement that its engines will comply with these requirements under all conditions which may reasonably be expected to occur in normal vehicle operation and use. The manufacturer must provide a detailed description of all testing, engineering analysis, and other information that forms the basis for the statement. This certification statement must be based on testing and/or research reasonably necessary to support such a statement and on good engineering judgement. This supporting information would have to be submitted to EPA at certification upon request; manufacturers would not necessarily be required to submit NTE test data for compliance during certification.

EPA believes that there are significant advantages to taking this sort of approach for heavy-duty engines. The test procedure is very flexible so it can represent most in-use operation and ambient conditions. Therefore, the NTE approach takes all of the benefits of a numerical standard and test procedure and expands it to cover a broad range of conditions. Also, with the NTE approach, in-use testing and compliance become much easier since emissions may be sampled during normal vehicle use. A standard that relies on laboratory testing over a very specific driving schedule makes it harder to perform in-use testing, especially for engines, since the engines would have to be removed from the vehicle. Testing during normal vehicle use, using an objective numerical standard, makes enforcement easier and provides more certainty of what is occurring in use versus a fixed laboratory procedure.

Even with NTE requirements, EPA believes that it is still important to retain standards based on the current heavy-duty engine test procedure. This is the standard that EPA expects the certified engines to meet on average in use. The NTE testing is more focused on maximum limits on emissions for segments of operation or engines used in certain applications or geographic regions and should not require additional technology beyond what is used to meet the applicable FTP standards. EPA believes that basing the emissions standards on a distinct cycle and using the NTE zone to help ensure in-use control creates a comprehensive program. The existing duty cycle includes low speed and low torque operation that are not included in the NTE zone. In addition, the standardized test cycle gives a basis for calculating credits for use in the averaging, banking, and trading program.

The NTE requirements for heavy-duty diesel engines are proposed to include other provisions including ambient temperature and humidity ranges and corrections (discussed below). Start up conditions are excluded from NTE testing because start-up is sufficiently covered by the cold start in the FTP and would be expected to be significantly higher than the proposed NTE limits for a short period of time.

The NTE test procedure could be run in a vehicle on the road or in an emissions testing laboratory using an appropriate dynamometer.[57] The test itself does not involve a specific driving cycle of any specific length (mileage or time), rather it involves driving of any type that could occur within the bounds of the NTE control area. The vehicle (or engine) would be operated under conditions that may reasonably be expected to be encountered in normal vehicle operation and use, including operation under steady-state or transient conditions and under varying ambient conditions. Emissions would be averaged over a minimum time of thirty seconds and then compared to the applicable NTE emission limits. The

[55] The emissions surface would include all points in the Supplemental Steady-State control area, as defined above.

[56] Torque is a measure of rotational force. The torque curve for an engine is determined by an engine ''mapping'' procedure specified in the Code of Federal Regulations. The intent of the mapping procedure is to determine the maximum available torque at all engine speeds. The torque curve is merely a graphical representation of the maximum torque across all engine speeds.

[57] Likewise, testing to determine compliance with the Maximum Allowable Emission Limits could be conducted in the laboratory or in a vehicle on the road.

applicable ambient conditions and the methodology for correcting emissions results for temperature and/or humidity are described in the following section. The proposed test procedure can be found in § 86.1370–2004 of the proposed regulations. We request comment on this test procedure and its applicability to HD diesel engines, particularly with respect to whether 30 seconds is an appropriate time over which to average emissions for comparison to the emission limits for HD diesel engines.

The definition of defeat device is being modified slightly to account for the NTE limits. Under the previous definition of defeat device, an auxiliary emission control device would not be considered a defeat device if it reduced the effectiveness of the emission control system under conditions that are substantially included in the federal test procedure.

This definition is less appropriate for the NTE requirements. The potential testing surface for the NTE encompasses much of the operating range of the vehicle. Therefore, a definition of defeat device that would exclude this testing surface would leave little area in which a defeat device could be found. This, however, is not the intent of the NTE. The NTE is not intended to be the primary emission limit on an engine, but is intended instead as a ''no worse than this'' requirement that puts an absolute high limit on emissions under most operating conditions. It is not supposed to supplant the continuing obligation of manufacturers to design their engines without defeat devices. Nor is it supposed to provide a cushion for manufacturers to meet a less stringent standard off the testing cycles. Therefore, EPA has revised the definition of defeat device such that substantial inclusion in the federal test procedure does not extend to the NTE zone.

The proposed NTE zone is illustrated in Figures 1 and 2. With the exception of two limited regions under the torque curve (described below), the NTE zone for diesels includes all engine operation at or above 30 percent of the maximum torque value of the engine and all engine operation at or above a specific engine speed calculated based on the maximum power of the engine.[58] This zone covers the areas of operation that are of most concern to the Agency from an environmental perspective. Because engines do not operate frequently at speeds that occur below the maximum torque peak (heavy-duty diesel engines generally operate at speeds near or above their maximum torque), the emissions generated from operation at lower speeds are relatively insignificant. The same is generally true of operation at below 30 percent of maximum torque—heavy-duty diesel engines do not spend much time in this region and the emissions generated in this region of operation tend to be less of a concern for the Agency. Manufacturers are still forbidden from using defeat devices both inside and outside the NTE zone, however.

For the reasons described below, two small regions are excluded (or ''carved out'') from the NTE zone defined above. First, we propose to exclude from the NTE zone the area under the torque curve that falls below the curve representing 30 percent of the maximum power value of the engine (as distinguished from maximum torque). This excluded region contains low engine speed and torque operation for which we believe current heavy-duty engines spend an insignificant portion of their operating lives. In addition, at low loads and low-to-mid speeds (low total power), the measurement of grams per brake-horsepower emissions tends to balloon, even while emissions go down. This region is proposed to be carved out for all pollutants.

Second, a PM-specific region is ''carved out'' of the NTE control area. The PM-specific area of exclusion is generally in the area under the torque curve where engine speeds are high and engine torque is low, and can vary in shape depending upon several speed-related criteria and calculations detailed in the regulations. Controlling PM in this range of operation presents fundamental technical challenges which we believe cannot be overcome in the 2004 time frame. Specifically, the cylinder pressures created under these high speed and low load conditions are often insufficient to prevent lube oil from being ingested into the combustion chamber. High levels of PM emissions are the result. Furthermore, we do not believe that these engines spend a significant portion of their operating time in this limited speed and torque range.

The definition of the proposed NTE zone and the carve-out areas strives to place an effective cap on emissions over a broad area of in-use operation that includes the types of operation that are of the greatest environmental concern. The definition of the control area, the carve-outs, and the emissions limit must all be balanced to achieve the Agency's goals. We believe that the combination of the proposed zone and the proposed emission limits within the zone effectively accomplish the Agency's goals of ensuring that emissions are controlled over a wide range of in-use operation. We request comment on the proposed zone and emission limits.

Examples of the NTE zone, including the areas excluded from the zone, are shown below in Figures 1 and 2. The A, B, and C engine speeds are the same as those defined for the advanced steady state test and described above and in the proposed regulations. Note that there are two possible constructions of the PM ''carve-out'' detailed in the draft regulatory language. The example in Figure 1 shows the PM carve-out as it would look if the C speed is below 2400 revolutions per minute (rpm), while Figure 2 shows the construct of the PM carve-out if the C speed is above 2400 rpm.

BILLING CODE 6560–50–P

[58] The maximum torque value and maximum power of the engine are derived as part of the engine mapping procedures specified in 40 CFR 86.1332.

Figure 1 -- Proposed NTE Zone for Heavy-Duty Diesel Engines -- C Speed < 2400 rpm

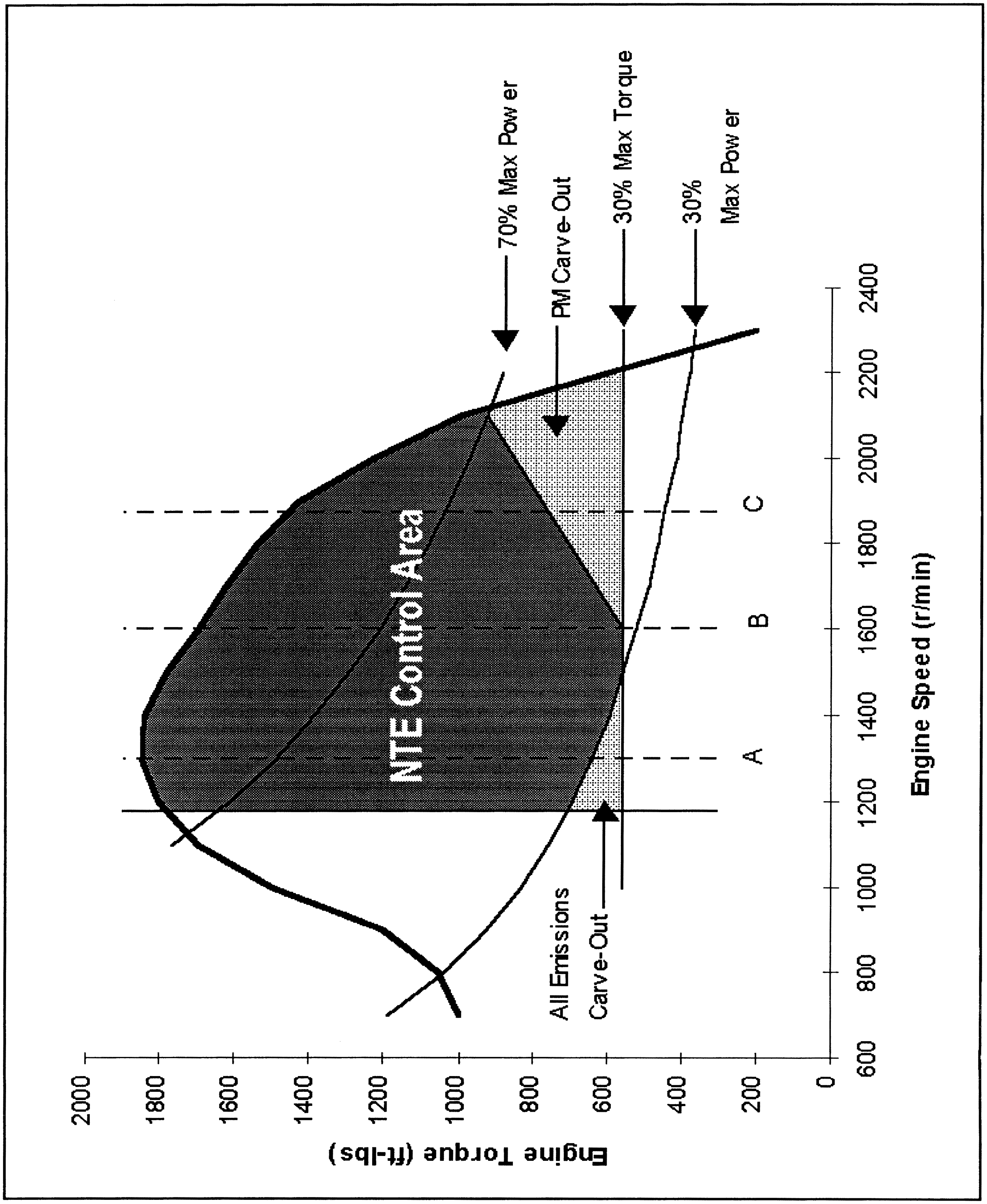
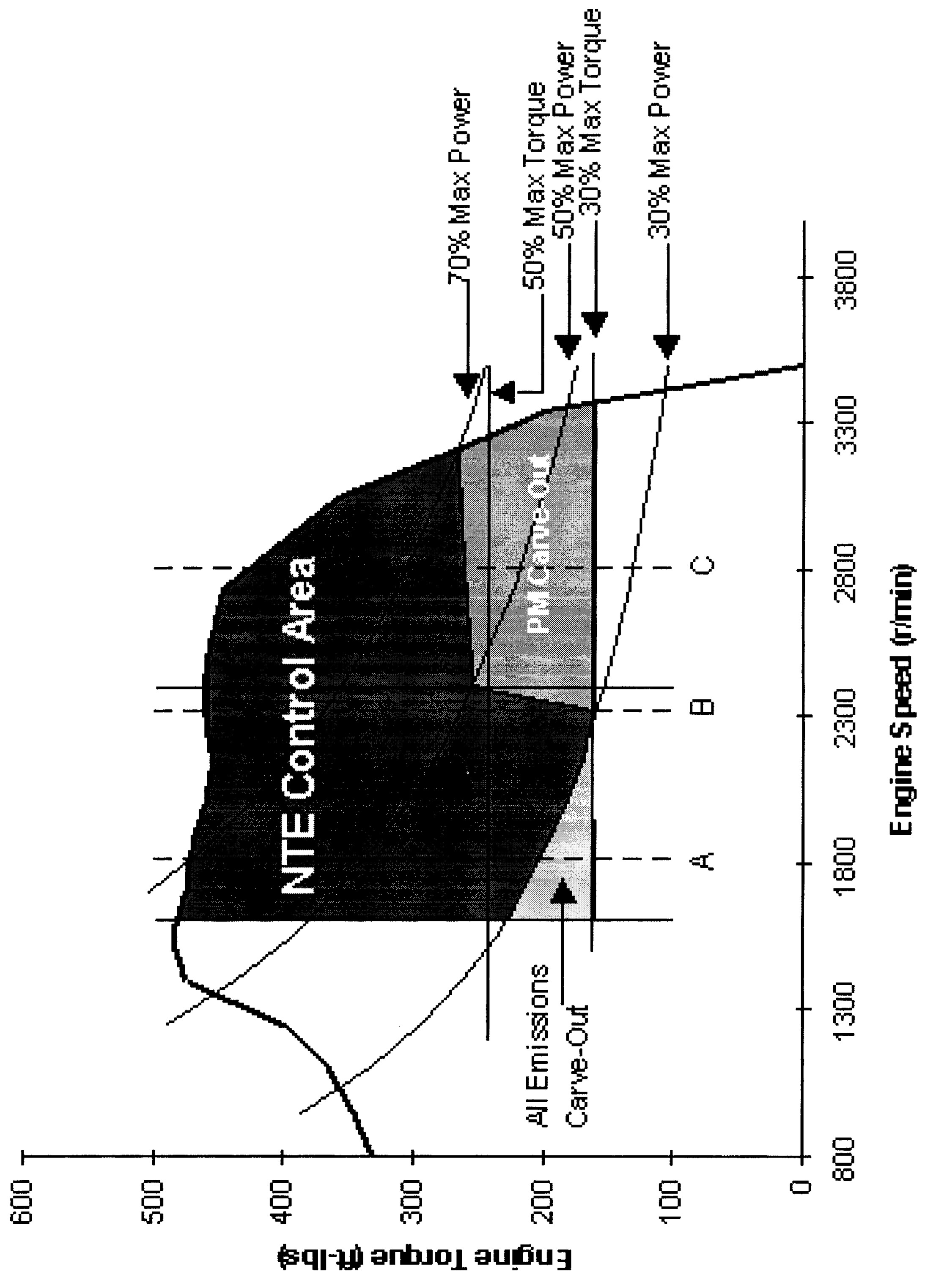


Figure 2 -- Proposed NTE Zone for Heavy-Duty Diesel Engines -- C Speed > 2400 rpm



BILLING CODE 6560–50–C

Within the NTE zone, EPA proposes that emissions of each of the regulated pollutants ($NMHC+NO_X$, CO, PM), when averaged over a minimum time of 30 seconds, must not exceed 1.25 times the applicable FTP standards (or FEL if ABT is used). A minimum 30 second average is proposed to ensure that a short transient does not produce high results. This 30 second sampling period should be long enough to allow an emissions spike to be averaged out while still retaining a short enough period to look at a specific type of operation. In addition, EPA proposes that within the NTE zone smoke and opacity must not exceed either a filter smoke limit of 1.0 (on the Bosch smoke number scale) or a thirty second average smoke opacity of four percent for a five inch path for transient testing and a ten second average smoke opacity of four percent for a five inch path for steady state testing.

c. Diesel Supplemental Load Response Test

Today we are also proposing a Supplemental Load Response Test (LRT) for heavy-duty diesel engines. This supplemental test is intended to represent a specific type of engine operation—rapid transient acceleration—that is not adequately represented in the current transient test procedure. Although the current transient test cycle does contain numerous transient operations, these transients are limited to the engine operating range exercised during the current FTP, not the broader range of operation which is covered by the Supplemental Load Response Test. Specifically, the Supplemental Load Response Test is intended to address diesel engine emissions performance during rapid transient accelerations from any speed within the NTE zone. As proposed, the test focuses on quantifying PM and NO_X emissions during the portion of a truck's operation where it accelerates rapidly and where certain engine emission controls can be inadequate. In addition, this type of operation can often produce visible smoke, which is frequently noticed by the public and can influence their opinions about the cleanliness of diesel engines.

We are not proposing specific emission limits for this test procedure at this time. Rather, we are proposing that manufacturers of heavy-duty diesel engines submit test results as part of their application for EPA certification. The test results to be submitted at certification would include testing, at a minimum, at a several engine speeds specified in the proposed regulations. As noted in section III.D, 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 $NMHC+NO_X$ and 1.7 times the FTP standard for PM. We believe that these limits may be appropriate and technologically feasible, but we also recognize that under the Consent Decrees there is a process of data collection and evaluation that could result in modifications to these limits sometime in the latter half of the year 2000. The data submittal requirements proposed today are consistent with the requirements in the Consent Decrees.

We believe that establishing a future Load Response Test with appropriate emission limits may be a valuable addition to EPA's compliance program, particularly for in-use on-road testing using the equipment specified in a later section of this document, 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 supplemental proposal. The proposed data submittal requirement would 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. Such a future action would consider including a requirement that manufacturers submit a statement of compliance at certification (similar to the approach proposed today for the NTE emission limits). We request comment on the proposed approach to a Load Response Test, as well as on the possibility of adding appropriate emission limits and certification requirements with a later action.

The test procedure as proposed is relatively straightforward. The engine fuel control is moved rapidly to the full fuel position and held at that point for a minimum of two seconds. As proposed, this sequence would be carried out in a laboratory environment at a constant speed setting, but in the future testing could be conducted using on-road equipment specified in a following section, in which case the vehicle speed would depend upon the characteristics and response of the vehicle being tested. The proposed regulations specify six different speeds, ranging from the lowest speed in the NTE control area to a high speed defined according to a calculation specified in the proposed regulations. The test sequence could be repeated if necessary to obtain an adequate sample for analysis (e.g., in the event that one cycle is inadequate for collecting enough particulate mass for gravimetric analysis). Although this could conceivably be carried out in several different ways, we encourage the use of methodologies that adequately represent the transient operation that is the true emphasis of this test procedure. The proposed test procedure can be found in proposed § 86.1380–2004.

d. Ambient Conditions, Temperature and Humidity, Laboratory and In-Use Testing

As stated above, our goal is to create a program that will ensure emission control over a wide range of in-use conditions, including ambient temperature and humidity. The FTP and Supplemental Steady State tests are laboratory-based test procedures that would be conducted under standard laboratory ambient conditions defined in the regulations, with emission results corrected according to existing regulations regarding laboratory testing procedures.[59] The NTE and verification of compliance with the Maximum Allowable Emission Limits could be conducted in the laboratory or during on-the-road driving, and the standards associated with these tests, where applicable, are proposed to apply under any ambient conditions. Within proposed temperature and humidity ranges, emissions from heavy-duty diesel engines must meet the requirements described above, without corrections for temperature and humidity. For situations in which the ambient conditions are outside these ranges, EPA proposes that NO_X be corrected for humidity and both NO_X and PM be corrected for temperature. Corrections would be to the end of the specified temperature or humidity range nearest the actual ambient conditions. We request comment on applying this expanded range of ambient conditions to the new supplemental test procedures, and on whether implementation of an expanded range should apply starting with the 2004 model year or some later model year.

For emission results to be compared to the NTE emission limits, we propose that the temperature range be from 55 to 95 degrees Fahrenheit (12.8 to 35.0 degrees Celsius) and that the humidity range be 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). The proposed temperature range encompasses the conditions exhibited by most days on which an exceedance

[59] The acceptable temperature range for FTP testing is defined by regulation as 68–86 degrees Fahrenheit. There is no specified humidity range, but NO_X emission results are to be corrected to 75 grains of water per pound of dry air.

of the ozone NAAQS is observed.[60] In addition, EPA analyses pertaining to a recent rulemaking effort concluded that the ''typical'' ozone nonattainment day exhibits a maximum temperature between 90 and 95 degrees Fahrenheit. (*See* 61 FR 54852, October 22, 1996). The relative humidity range being proposed today reflects the current understanding of humidity corrections, in that higher humidity typically results in lower NO_X levels. Therefore, NO_X test results from a truly hot and humid day (e.g., a ''typical'' ozone exceedance day where the maximum temperature is in the 90's and the humidity is about 100 grains of water per pound of dry air, or 40 percent relative humidity) would be adjusted upward by the correction factor when correcting back to the drier conditions of the specified range, thus providing environmental protection during hot and humid conditions typical of ozone exceedance days. For emission results to be compared to the Maximum Allowable Emission Limits we propose that NO_X emissions be corrected to a standard level of 75 grains of water per pound of dry air and that NO_X and PM emissions be corrected to the nearest endpoint of the range from 68 to 86 degrees fahrenheit if tested outside this range. The proposed corrections for verifying compliance with the Maximum Allowable Emission Limits would correct emission results to standard laboratory conditions used for FTP testing because these emission limits are derived from testing under the standard laboratory conditions. We request comment on these proposed ranges.

At this time, EPA is working with HD diesel engine manufacturers on developing humidity and temperature correction factors. In the future, it is EPA's intent to adopt the correction factors that are developed through this effort. Because the correction factors are not yet developed, EPA proposes only that good engineering judgement be used when correcting for humidity and temperature outside of the proposed ranges.

3. Access to On-Board Computer Information

Modern HD diesel and gasoline engines make extensive use of electronics for engine control and management. HD engines make extensive use of on-board computers for fuel system control, and other emission-related component control, which in the future will likely include cooled EGR systems on HD diesel engines. Many of these newer systems make use of Controller Area Networks as a means of communicating information from the on-board electronic control module (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. EPA is concerned that electronic controls (or any other Auxiliary Emission Control Devices) not be used in such a way as to result in higher emissions from HD engines in use than would be seen during certification or laboratory testing. Therefore, EPA must have access to this information. We are proposing that, upon request from EPA, engine manufacturers must provide to EPA hardware and/or documentation necessary to read and easily interpret (in engineering units if applicable) any information broadcast by on-board computers and ECM's which relate in anyway to emission control devices and auxiliary emission control devices (AECD). This proposed requirement includes access to proprietary code information which could not otherwise be interpreted by parties other than the engine manufacturer, EPA would retain any legitimate confidential business information as such. This requirement could include the delivery, upon request from EPA, from the manufacturer to EPA the most up to date scantool hardware used by the engine manufacturer for monitoring, interpreting, and recording all emission related electronic input and output data broadcast on an engine's on-board controller network. The requirement could also include access to passwords which would enable a generic scan tool or personal computer to read and interpret proprietary codes, if such passwords exist. EPA requests comment on these requirements.

E. Otto-Cycle Vehicle-Based Program

Heavy-duty Otto-cycle vehicles can be split into two groupings, complete and incomplete vehicles. Complete vehicles are those that are manufactured with their cargo carrying container attached. Complete vehicles consist almost entirely of pick-up trucks, vans, and sport utility vehicles and account for about 75 percent of all Otto-cycle heavy-duty vehicle sales. All complete vehicles are currently below 14,000 pounds GVWR. Incomplete vehicles are those chassis that are manufactured without their cargo carrying container attached. These chassis may or may not have a cab attached. The incomplete chassis are then manufactured into a variety of vehicles such as recreational vehicles, tow trucks, dump trucks, and delivery vehicles. Currently, there are three original equipment manufacturers (GM, Ford, and Daimler Chrysler) of heavy-duty Otto-cycle engines and they also manufacturer all of the complete vehicles in which those engines are used.[61] These manufacturers also manufacture most incomplete chassis equipped with Otto-cycle engines.

Currently, EPA requires heavy-duty engines to be tested to engine-based standards. Light-duty vehicles and light-duty trucks are required to be tested over a vehicle-based test commonly known as the light-duty federal test procedure, or FTP. Heavy-duty vehicle manufacturers have the option of testing heavy-duty vehicles up to 14,000 pounds GVWR over the light-duty FTP to light-duty truck standards (EPA ''heavy-as-light'' testing provisions), rather than to EPA engine-based standards.

As part of their medium-duty vehicle program, California requires complete Otto-cycle vehicles between 8,500 and 14,000 pounds to be certified to vehicle-based standards rather than engine-based standards. Manufacturers test the vehicles in essentially the same manner light-duty trucks are tested. California has established Low Emission Vehicle (LEV and LEV-II) standards for these vehicles. In the MDV program, engines used in incomplete vehicles and vehicles above 14,000 pounds may be certified to engine-based standards rather than vehicle standards. Diesel powered vehicles are also allowed to be certified to engine-based standards as an alternative to the vehicle standards, and in fact, most if not all manufacturers choose the engine-based standards for their diesels.

Today's proposal recognizes that manufacturers have found the option to certify diesel vehicles to the California chassis-based standards not particularly useful, and as a result the ability to certify diesels to the chassis-based standards proposed below is not included in the proposal. However, we request comment on this issue, and if this option is indeed a desirable one, we would add the California MDV PM standard of 0.12 grams/mile to the regulations for manufacturers that select this option. In addition, we request comment on the possibility of *requiring*

[60] Memorandum, Mark Wolcott, EPA, to Charles L. Gray, EPA, ''Ambient Temperatures Associated With High Ozone Concentrations,'' September 6, 1984. Available in the public docket for review.

[61] There are also aftermarket alternative fuels conversion manufacturers, as discussed in section E.7, below.

complete diesel heavy-duty vehicles under 14,000 pounds GVWR to be subject to chassis-based standards, and if so, whether the standards proposed for complete Otto-cycle vehicles or some other set of standards (perhaps the proposed Otto-cycle standards adjusted by an appropriate factor) would be appropriate for chassis-certified heavy-duty diesel vehicles.

1. Moving to a Vehicle-Based Test Procedure and Standards

EPA proposes to adopt vehicle-based standards and test procedures for complete Otto-cycle vehicles between 8,500 and 14,000 pounds GVWR. As in the California MDV program, these complete vehicles would be tested on the federal light-duty vehicle and light-duty truck test procedure.[62] EPA believes this approach is reasonable and offers several advantages over engine-based testing. In addition, EPA is proposing to refine the program further by incorporating some complete Otto-cycle vehicles between 8,500 and 10,000 pounds GVWR into the Tier 2 program proposed earlier this year (see Section IV.F for details regarding this aspect of the proposal). Many of the full size pick-up trucks, vans, and sport-utility vehicles which have a GVWR above 8,500 pounds are often used by owners for personal transportation, and a chassis-based test procedure incorporating the light-duty FTP cycle is representative of this type of transportation and operation. The harmonization of test procedures with California allows for certification data to be used for both federal and California certification requirements, reducing the testing burden for manufacturers. In addition, because vehicle testing is less resource intensive than engine testing, EPA and manufacturers will be better able to conduct in-use testing to verify emissions compliance.

In developing the proposal, EPA met with a number of stakeholders and during these discussions several stakeholders supported EPA's consideration of a chassis-based program, similar to California's MDV program.[63] Manufacturers presented EPA with a proposal for a chassis-based program after EPA expressed its substantial interest in moving to chassis-based testing. Manufacturers expressed interest in EPA's adoption of a program that would allow them to use one set of certification information for both California and EPA. Other stakeholders were also supportive of the move to a chassis-based requirement due to the benefits noted above.

2. Vehicle Exhaust Emissions Standards

EPA proposes to adopt the chassis-based standards contained in Table 4 below for model years 2004 and later. The numeric levels were selected to match the full life emissions standards in place for California's MDV program for LEV vehicles above 8,500 pounds GVWR. The standards would apply to complete vehicles in the weight categories shown. The standards are for emissions over the FTP and vehicles would be tested at adjusted loaded vehicle weight (ALVW), also known as test weight (TW).[64]

TABLE 4.—EPA PROPOSED FULL-LIFE EMISSION STANDARDS MODEL YEARS 2004 AND LATER

[Grams per mile]

Vehicle weight category (GVWR)	Nonmethane organic gas (NMOG)	NO_X	CO
8,500–10,000 lbs*	0.28	0.9	7.3
10,001–14,000 lbs	0.33	1.0	8.1

*Excluding those vehicles covered by the proposed Tier 2 program, as described in Section IV.F of this proposal.

We believe that these proposed standards reflect the most stringent standards achievable for the 2004 model year, considering cost and other appropriate factors, and are therefore consistent with the requirements of the CAA. As discussed in the Technological Feasibility section below, LEV technologies are being required in California beginning in 1998 and will be fully phased in beginning in 2004. By harmonizing the federal and California standards, this proposal would allow manufacturers to take advantage of the research and development that they have undertaken to meet the California requirements. While it is true that a small percentage of vehicles that have not been offered for sale in California would, under the proposal, be required to meet lower vehicle standard, EPA believes that the decision not to market such vehicles in California was typically related more to their very small sales volumes rather than for technological reasons. Manufacturers would have some flexibility in meeting the standards, and therefore some capability to deal with issues such as this, by today's proposal to apply an ABT program to heavy-duty Otto-cycle vehicles.

In a recent NPRM, we proposed to reduce the sulfur in federal test fuel to reflect the reductions in sulfur we proposed for commercial gasoline.[65] Currently, federal test gasoline is subject to a limit of 0.10 percent sulfur by weight. We proposed to amend that to an allowable range of 30 to 80 ppm (0.003 to 0.008 percent by weight). We also proposed that vehicles be certified and in-use tested using federal test fuel. However, where vehicles are certified for 50 state sale, and where other testing issues do not arise, we proposed to accept for purposes of certification the results of testing done for California certification on California Phase II fuel, but we would reserve the right to perform or require in-use testing on federal fuel. Where vehicles are only certified for non-California sale, we proposed to require certification and in-use testing on federal fuel. These provisions, if finalized as proposed, would apply to heavy-duty vehicles certified to the chassis-based provisions in this proposal.

EPA is proposing a hydrocarbon standard in the form of nonmethane organic gas (NMOG) in order to be consistent with California's MDV standards. EPA proposes to also accept hydrocarbon emissions in the form of NMHC or total hydrocarbons (THC) in

[62] Test procedures contained in 40 CFR Part 86 subpart B, excluding the Supplemental FTP.

[63] Stakeholders involved in these discussions included representatives from states, environmental groups, emission control equipment manufacturers, and engine manufacturers. See Docket A–95–27, IV–E, for more information on these discussions.

[64] ALVW or TW is the actual weight of the vehicle, known as curb weight, plus half pay load. Its also the average of the curb weight and GVWR, which is curb weight plus full pay load.

[65] 64 FR 26003, May 13, 1999, ''Control of Air Pollution From New Motor Vehicles: Proposed Tier 2 Motor Vehicle Emissions Standards and Gasoline Sulfur Control Requirements''.

lieu of NMOG, These are forms of hydrocarbon standards which are the standards typically used by EPA under the heavy-duty Otto-cycle control program. Accepting emissions in these various forms provides manufacturers with additional flexibility since establishing NMOG levels can be more complex than NMHC or total hydrocarbon levels. Manufacturers submitting California certification data would submit NMOG emissions data due to California requirements.

The vehicle manufacturer would be responsible for determining whether a vehicle is a complete vehicle and subject to the vehicle-based standards or an incomplete vehicle and subject to engine-based standards. The manufacturer would make this determination based on the definition of incomplete vehicle described above. The vehicle manufacturer may request a determination from EPA when the status of a specific vehicle model is unclear. Manufacturers of complete vehicles are responsible for vehicle emissions certification, as is the case currently in EPA light-duty vehicle programs. More details on vehicle compliance are provided in section E.5 below. Although currently uncommon in this segment of the market, a vehicle manufacturer may purchase engines from another manufacturer to place in incomplete vehicles. In such cases, the vehicle manufacturer would be responsible for ensuring that the engines they purchase have been emissions certified to EPA's engine-based standards by the engine manufacturer. The engine manufacturer would be responsible for the engine certification and emissions performance of the engines, as is the case currently in EPA's engine programs.

The approach EPA is proposing is based on the technological feasibility of extending the use of LEV technologies from California to nationwide use in the 2004 MY time frame. The standards selected are based on the capabilities of technologies designed to meet the LEV standards. The approach of allowing the option of using California certification data is intended to avoid duplication of effort for the manufacturers. EPA requests comments on the proposed approach for chassis-based testing and the proposed standards.

3. Heavy-Duty Vehicle Averaging, Banking and Trading

a. Background

Averaging, Banking, and Trading is a long-established mechanism allowing the Agency to propose and finalize a more stringent standard than might otherwise be appropriate under the CAA, since ABT reduces the cost and improves the technological feasibility of achieving the standard. Manufacturers are able to bank credits by certifying some engine families to emissions levels lower than applicable standards. The credits may be banked and then used to certify other engine families to levels higher than the emissions standards. For HD Otto-cycle engines, ABT is available for meeting NO_X standards. Under the current ABT program, banked credits are discounted by 20 percent and have a three year life, after which they expire.[66]

In the final rule for diesel engine standards for MY 2004 and later, EPA modified the ABT program for diesel engines with the intent that the changes would enhance the technological feasibility and cost-effectiveness of the new standard, and thereby to help to ensure that the new standard would be attainable earlier than would otherwise be possible.[67] EPA reduced the discount rate to 10 percent and established a cut point under which an engine family would earn undiscounted credits. Also, EPA removed the three year credit life limit which allows manufacturers to earn credits to be used in 2004 and later as early as the 1998 model year. EPA modified the HD diesel ABT program, among other reasons, because the Agency believes that the 2004 and later standards are stringent technology-forcing standards and the additional flexibility would improve the manufacturer's ability to comply with the standards cost effectively and in a manner that would not disrupt product planning.[68] EPA did not adopt the modified program for Otto-cycle engines at that time, however, because the Agency did not finalize the proposed standards for Otto-cycle engines.

The CAA requires that EPA set emission standards with appropriate consideration to feasibility and cost. We believe that the ABT programs in today's proposal are appropriate in the context of the technical feasibility and the cost of the proposed emission standards. For all of these reasons, we are proposing an ABT program for the vehicle-based standards.

b. Proposal

EPA is proposing separate averaging, banking, and trading programs for vehicles certified to the vehicle-based standards and engines certified to the engine-based standards. This section addresses the proposed ABT program for the vehicle-based standards. The proposed engine-based ABT program is discussed above in section IV.C. EPA is also requesting comment on the possibility of allowing credit exchanges between the engine and vehicle ABT programs. This issue is discussed below in the following section.

For vehicles, EPA proposes an ABT program structured similar to the modified ABT program described above for engines. EPA proposes the following provisions:

- Beginning in 2000, manufacturers could bank vehicle-based credits by choosing to certify vehicles rather than engines
- Manufacturers would earn NO_X credits up to the applicable 2004 NO_X standard by establishing an FEL below the 2004 standard
- Vehicles with FELs at or below 0.6 g/mile NO_X would earn undiscounted credits, engines with FELs above 0.6 g/mile would earn credits discounted by 10 percent
- 2004 and later model year vehicles using credits may not exceed a NO_X level 1.53 g/mile
- Heavy-duty Otto-cycle vehicles would be a single grouping or averaging set.

EPA recognizes that manufacturers would be required to achieve NO_X levels lower than the proposed 2004 NO_X standards in order to generate credits prior to 2004, and that this aspect of the program differs from the proposed program for engines. Based on current vehicle certification data from the California LEV program, some vehicle models have demonstrated the potential for very low NO_X emissions in the 0.2 to 0.5 g/mi range. We believe there would be the potential for credit generation in the proposed program if similar technologies were used nationwide prior to 2004. In addition, manufacturers are required to meet the proposed standards in California prior to 2004 and therefore will be well on their way to transitioning to the standards. They are already designing vehicles to meet the standards in California. Therefore, the importance of banked credits is likely to be diminished for vehicles compared to engines.

---

[66] With ABT, manufacturers are able to establish a Family Emissions Limit (FEL) for an engine family which becomes the standard for that family. Manufacturers earn or use credits based on the difference between the FEL and the applicable standard. A full overview of the ABT program is contained in EPA's 1996 NPRM, 61 FR 33451.

[67] 62 FR 54694, October 21, 1997.

[68] For a more complete discussion of the ABT provisions relating to the 2004 model year heavy-duty diesel engine standards, see Summary and Analysis of Comments: Control of Emissions of Air Pollution from Highway Heavy-Duty Engines, September 16, 1997, EPA Air Docket A–95–27, Doc. No. V–C–01.

The ABT program can help manufacturers certify especially difficult or low volume applications and help manufacturers comply across their full product line without having to restrict vehicle offerings. The Agency believes the proposed program offers sufficient flexibility in light of the technology and cost requirements associated with the proposed standards. Based on current certification data and technological capabilities we believe manufacturers will have opportunities to generate credits to help with meeting the proposed 2004 standards. Moreover, because these standards are required in California for several model years prior to 2004, EPA does not expect feasibility issues with the vast majority of vehicle models.

c. Credit Exchanges Between the Engine and Chassis-Based Programs

We believe that credit exchanges between the separate engine and chassis-based ABT programs might be appropriate, as well as desirable for manufacturers, but unresolved concerns and issues (described below) prevent a proposal to allow such exchanges at this time. If these concerns can be addressed prior to the final rulemaking we will consider finalizing provisions allowing credit exchanges between the two ABT programs. Specific concerns include derivation of engine and vehicle-specific conversion factors, the possibility of large quantities of credits effectively delaying the introduction of cleaner vehicles and/or engines, and the method for exchanging vehicle-based NO_X credits with engine-based $NMHC+NO_X$ credits (or vice versa), and whether the emissions standards would continue to be appropriate if such a broader credit exchange program was allowed.

The chassis-based ABT program is based on emissions in units of grams per mile (g/mi) and the engine ABT program is based on emissions in units of grams per brake horsepower-hour (g/bhp-hr). Consequently, trading credits between the two programs would require a conversion factor. Although the Agency uses conversion factors to estimate g/mi emissions based on g/bhp-hr emissions rates for purposes of emissions inventory modeling, these conversion factors are estimates of a fleet average, not an engine- or vehicle-specific conversion factor. There is considerable variation in the conversion factors from vehicle to vehicle. Also, conversion factors that have been previously derived don't necessarily predict emissions over the specific test cycles. Both the emission standards and the ABT credits are based on emissions over specific test cycles. Conversion factors developed for specific engines and vehicles on specific test cycles could vary widely from an ''average'' conversion factor. EPA believes that vehicle and engine test cycle specific conversion factors would be needed in order to allow transfers of credits between the two Otto-cycle ABT programs.

In general, EPA believes that provisions allowing the exchange of credits between the two Otto-cycle ABT programs should include a conversion factor for each engine family for which the manufacturer intends to develop transferable credits. Each conversion factor would likely have to be based upon a number of engine and vehicle tests, and would have to be approved by EPA prior to use. To ensure adequate emissions control, EPA would consider requiring the conversion factors to be developed by testing engines and vehicles expected to generate ''worst-case'' emissions. EPA requests comment on how to structure a program that manufacturers would be required to use to develop appropriate conversion factors for each engine family.

The ability to trade credits between the engine and chassis-based ABT programs is not needed prior to the 2004 model year and would unnecessarily complicate the ABT programs, for the following reasons. Prior to the 2004 model year, EPA emission standards for heavy-duty Otto-cycle vehicles are engine-based standards. Absent any credit exchange provisions, manufacturers could still generate vehicle-based credits by voluntarily certifying engines to the vehicle-based program. These provisions already provide the flexibility for manufacturers to decide how many engine-based and vehicle-based credits to generate.

Manufacturers will have the opportunity to generate Otto-cycle engine-based credits prior to the 2004 model year due to the structure of the proposed Otto-cycle engine-based ABT program. These engine credits could be used by manufacturers to facilitate meeting the proposed engine standard. However, EPA is concerned that significant quantities of engine-based credits could flow to the chassis-based program, thus potentially having the effect of significantly postponing the introduction of vehicles with emission levels below the proposed vehicle standards. EPA would likely want to structure provisions for exchanging credits such that the exchanges would be limited for use in averaging and trading within a given model year, but banked credits could not be exchanged. EPA requests comment on structuring credit exchanges in this manner.

For the 2004 and later model years, the proposal would require manufacturers to certify a large portion of their Otto-cycle heavy-duty vehicles to the vehicle-based provisions (via chassis testing), thus reducing the opportunity to generate Otto-cycle engine-based credits. In addition, the proposed engine-based emission standards would be significantly more stringent starting with the 2004 model year, thus making generation of engine-based credits more difficult. For these reasons, exchanging credits earned starting in the 2004 model year between the chassis-based and engine-based ABT programs may be a desirable option for manufacturers.

Another issue for credit exchanges in 2004 and later model years is that vehicle credits would be based on NO_X only emissions and the engine credits would be based on $NMHC+NO_X$ emissions. EPA believes that the NMHC portion of engine emissions compared to NO_X emissions is about 15 percent of total emissions, or between 0.1 and 0.2 g/bhp-hr. EPA requests comment on allowing credit exchanges without regard to this difference in the standards, or alternatively, requiring the use of an appropriate factor (e.g., the 15 percent factor noted above) to apply to exchanges of NO_X-only and $NMHC+NO_X$ credits.

To summarize, EPA is not proposing allowing exchanges between the two Otto-cycle ABT programs at this time, but will consider finalizing provisions that would allow such exchanges if our concerns can be addressed. Specifically, EPA requests comments on the following issues:

- Allowing manufacturers to transfer credits between the Otto-cycle engine and vehicle ABT programs;
- Restricting the transfers of credits between the two ABT programs to credits earned in the 2004 and later model years;
- The derivation of conversion factors that would make transfers of credits appropriate, including the test methodology and appropriate engine and vehicle parameters used to derive the factors (horsepower, vehicle weight, etc.);
- Ensuring that credit exchanges do not effectively delay introduction of cleaner vehicles;
- How to address exchanging NMHC credits with $NMHC+NO_X$ credits and vice versa;
- Limiting the exchange of credits to engines and vehicles below 14,000 pounds GVWR because engines rated for vehicles above this would not have any

counterparts certified to chassis-based provisions.

- Limiting the exchanges between the two Otto-cycle ABT programs to averaging and trading only.
- What impact the broader exchange program would have on the degree of the emission reduction of the standards and the appropriateness of such an approach.

4. Evaporative Standards/Onboard Refueling Vapor Recovery

Consistent with the proposal to move all complete vehicles 8,500 to 14,000 lbs GVWR from the current engine-based program to a chassis-based program, EPA is proposing that such vehicles also be certified according to the chassis-based enhanced evaporative test procedures. In addition, the Agency is proposing to require complete HDVs to meet an ORVR standard in a manner similar to that required of heavy light-duty trucks. Each of these provisions is discussed in depth in the following sections. The Agency is not proposing any changes to the current evaporative emission standards or test procedures for the engine-based program at this time.

a. Enhanced Evaporative Emissions

In 1993, EPA adopted enhanced evaporative test procedures for LDVs, LDTs and HDVs to be phased in beginning with the 1996 model year, with full compliance required by the 1999 model year (*see* 55 FR 16002, March 24, 1993). Under the enhanced evaporative requirements adopted in 1993 the provisions for LDVs and LDTs are essentially the same as those for HDVs with two main differences. The first difference is that the actual levels of the emission limits are higher for HDVs due to their typically larger fuel tanks. EPA is not proposing any changes to the HDV numerical evaporative limits in this proposed rule. The second difference is in the driving cycles used in the test sequence, as described in the next paragraph.

The urban dynamometer driving schedule (UDDS) used for HDVs is somewhat shorter than that used for light-duty, both in terms of mileage covered and minutes. What this means in practical terms is that, while the light-duty and heavy-duty procedures generally parallel each other, under the heavy-duty procedure there is considerably less driving time than under the light-duty procedure. This results in considerably less time for canister purge under the heavy-duty procedure than under the light-duty procedure.

EPA recognizes this discrepancy between its light-duty and heavy-duty programs, and has routinely provided waivers under the enhanced evaporative program which allow the use of the light-duty procedures for heavy-duty certification testing. The Agency does not believe that this approach impacts the stringency of the standards. Further, it is consistent with CARB's treatment of medium-duty vehicles. EPA is proposing that this approach be formally adopted for all complete vehicles which are certified according to the provisions of the chassis-based program discussed elsewhere in this notice. The Agency requests comment on this approach to evaporative emissions testing for complete HDVs, and also requests comment on whether it should be extended to those HDVs which will remain in the engine-based program.

b. Onboard Refueling Vapor Recovery

Onboard refueling vapor recovery systems prevent the fuel vapors which are displaced from a vehicle's fuel tank during refueling from entering the atmosphere. Typically, the displaced fuel vapors are routed to a charcoal canister where they are subsequently routed to the engine to be burned as fuel. EPA adopted ORVR requirements applicable to light-duty vehicles and light-duty trucks (*see* 59 FR 16262, April 6, 1994). These requirements are being phased in beginning with the 1998 model year for LDVs, the 2001 model year for light LDTs (6,000 lb and under GVWR), and 2004 for heavy LDTs (6,001 through 8,500 lb GVWR).

During the original ORVR rulemaking, EPA chose not to apply ORVR to HDVs for several reasons. First, a sizeable percentage of HDVs are sold as incomplete vehicles. In such cases EPA is concerned that secondary manufacturers may improperly modify or incorrectly complete the vehicle fuel system (which is usually not fully installed for incomplete vehicles). In such cases the primary manufacturer may have legal liability for potential problems. Second, the application of ORVR to HDVs could be more difficult than to LDVs and LDTs. This is because HDV fuel systems are sometimes configured differently than their LDV/LDT counterparts. This is especially true of the larger HDVs which tend to have large fuel tanks with short or almost nonexistent fillnecks. Finally, under the current HDV regulatory scheme, the engine would be certified separately from the ORVR system. This would result in additional challenges in matching the canister purge provided by the engine with the needs of each ORVR system.

EPA still believes that the above mentioned concerns are valid for some HDVs. However, the Agency also believes that, in light of the proposal to move to a chassis-based compliance program for complete vehicles, they are only valid for the larger, incomplete vehicles. The majority of HDVs are simply heavy-duty configurations of LDTs, with fuel systems similar to or the same as their light-duty counterparts. With this in mind EPA is proposing to require ORVR controls on all complete HDVs up to 10,000 GVWR in the same manner and on the same schedule as heavy LDTs. Thus, complete HDVs will be required to meet a refueling emission standard of 0.20 grams per gallon of fuel dispensed. For purposes of ORVR applicability, EPA is proposing that complete vehicle means a vehicle that leaves the primary manufacturer's control with its primary load carrying device or container attached.

The proposed ORVR standard would be phased in with 40 percent compliance required in the 2004 model year, 80 percent compliance in the 2005 model year, and 100 percent compliance in the 2006 model year. This phase-in is the same as that currently in place for heavy LDTs. EPA believes that using the same phase in schedule for heavy LDTs and HDVs will allow for a lower cost and easier phase in, since many HDVs are simply heavy duty versions of light duty configurations. Further, EPA is proposing that heavy LDTs and HDVs be considered a single category for the purposes of the phase in. In other words, the percent compliance requirements for a given model year would apply to heavy LDTs and HDVs as a single group, rather than to each group separately. EPA recognizes that combining these two categories into one may have the effect of modifying the stringency of the existing LDT requirements. However, EPA believes that this is appropriate because it will allow for additional flexibility in the implementation of ORVR systems that may be the same for heavy LDTs and HDVs. Also, given the proposed phase-in requirements, if less than the required percentage of heavy LDTs are certified to the ORVR requirement, it follows that greater than the required percentage of the heavy-duty vehicles would have to be certified to the ORVR requirements.

As was previously mentioned, EPA is proposing to phase in ORVR to HDVs in the same way as it is being phased in for heavy LDTs. This is because most covered HDVs are simply heavy-duty versions of light-duty configurations, and the ORVR systems developed for the light-duty configurations can be readily applied to their heavy-duty counterparts. However, EPA is aware that not all covered HDVs have light-duty counterparts. Given the number of other emission requirements taking effect in 2004, EPA believes that the manufacturers' development resources may be spread thin prior to 2004, making development of ORVR systems for HDVs which do not have a light-duty counterpart excessively burdensome in that time frame. Thus, EPA is considering alternative timing options for the application of ORVR to HDVs that do not have light-duty counterparts. One alternative is to simply require ORVR on these vehicles (those that do not have light-duty counterparts) in 2006, with no phase in prior to 2006. EPA requests comment on this option, as well as other alternatives. EPA also requests comment on how to best define which HDVs do not have light-duty counterparts for the purposes of determining which vehicles may be subject to the alternative implementation date. Finally, EPA requests comment on whether such a delay of ORVR for HDVs without light-duty counterparts is appropriate or needed.

EPA is proposing to limit the application of ORVR to HDVs of 10,000 lb GVWR and under because the vast majority of HDVs which have light-duty counterparts fall into this category. For the most part application to HDVs of 10,000 lbs GVWR and under should not present any new technological challenges. The technology applied for light-duty configurations should be readily transferrable to their heavy-duty counterparts. The Agency does not believe that limiting the ORVR provisions to vehicles 10,000 lbs and under results in any significant compromise in environmental benefits since almost all HD Otto-cycle complete vehicle sales are of vehicles 10,000 lb or less GVWR.

Currently, in the review of certification applications for ORVR-equipped LDVs and LDTs, EPA studies the design of the vehicle's ORVR system, its on-vehicle configuration and operation, and consults directly with the National Highway Traffic Safety Administration on these applications. EPA expects to extend this practice of consulting with NHTSA in the review of certification applications for ORVR-equipped HDVs as well.

EPA requests comment on all aspects of today's ORVR proposal. Specifically, the Agency requests comment on whether the proposed definition of complete vehicle for ORVR purposes adequately covers those vehicles for which ORVR application will present no substantial new challenges, while exempting those vehicles for which concerns expressed by EPA in the original ORVR rulemaking remain valid.

5. Compliance Assurance Program

On July 23, 1998, EPA proposed a new compliance assurance program for light-duty vehicles and light-duty trucks known as ''CAP 2000'' (*see* 63 FR 36954, July 23, 1998). The light-duty CAP 2000 program final rule was published on May 4, 1999 (*see* 64 FR 23906, May 4, 1999), with only minor changes from the proposed program. In brief, as compared with EPA's traditional chassis-based compliance program, CAP 2000 is designed to redirect manufacturer and Agency efforts towards in-use compliance and give manufacturers more control of certification timing, and yet maintain the integrity of the compliance assurance program. Aspects of the CAP 2000 program include streamlined certification, manufacturer in-use testing.

In today's action, EPA proposes that the CAP 2000 program would be the compliance assurance program for heavy-duty vehicles certified to chassis-based standards (hereafter referred to as ''chassis-based HDVs'').[69] EPA has proposed modifications to Part 86, Subpart S, that would extend the applicability of CAP 2000 to chassis-based HDVs. Key aspects of the proposed CAP 2000 program as it would apply to chassis-based HDVs are described below, followed by a discussion of issues and possible modifications to the light-duty CAP 2000 program considered by the Agency in the development of the proposal to extend the CAP 2000 program to chassis-based HDVs.

EPA believes that it is appropriate to extend the CAP 2000 program to chassis-based HDVs for the following reasons. First, CAP 2000 for HDVs would provide pre-production certification flexibilities, while providing an emphasis on checking real in-use emissions, as compared with the traditional light-duty chassis-based compliance program. As with light-duty vehicles, EPA believes that it is appropriate to improve pre-production compliance procedures, to reduce the manufacturer's certification burden, and to shift the focus of compliance assessment towards in-use testing, which is expected to generate significant amounts of in-use data that are currently not available. Second, applying CAP 2000 to chassis-based HDVs would align EPA's chassis-based compliance programs for light-duty vehicles, light-duty trucks, and heavy-duty vehicles. Third, EPA's proposal to extend CAP 2000 to chassis-based HDVs would further harmonize the EPA and ARB programs for this industry. The California Air Resources Board is adopting the CAP 2000 program for chassis-certified medium-duty vehicles in the 8,500 to 10,000 gross vehicle weight range, beginning in the 2001 model year.

a. CAP 2000 for HDVs

For the certification process, manufacturers would divide their product lines into new units called ''durability groups'', determined according to common emission deterioration elements. A vehicle with the ''worst case'' durability would be chosen from the durability group to establish the rate of emission deterioration expected from that group. The procedures used to determine durability would be developed by the manufacturer, with EPA approval. Durability groups would then be subdivided into ''test groups'', and a vehicle representative of each test group would be tested to show emission compliance. Once compliance has been demonstrated, certification could proceed. The CAP 2000 program provisions for information collection are streamlined from the traditional light-duty chassis-based compliance regulations. The timing of information submittal has been optimized to provide some flexibility for manufacturers, and the amount of information has been reduced, without compromising the Agency's information needs for future compliance or enforcement issues.

A second element of the proposed chassis-based HDV CAP 2000 requirements is manufacturer in-use testing. There are two parts to the program. Part one requires manufacturers to perform in-use emission testing on privately owned vehicles in an ''as-received'' state. This ''in-use verification testing'' would occur on low mileage and high mileage test fleets. The size of the low and high mileage fleets would be dictated by sales categories. Small volume manufacturers and small volume test groups would have little or no testing, depending on sales limits. In-use verification testing data would be used by the manufacturer to improve the predictive quality of its durability program, and by the Agency to target vehicle testing for a recall program. Part

[69] The compliance assurance program for heavy-duty engines subject to engine-based standards is discussed in section II.C.2 of this preamble.

two requires manufacturers to conduct additional testing of a test group when the in-use verification program data for the test group equals or exceeds a mean of 1.3 times the standard, with a 50 percent or greater failure rate for the test group sample at either the low or high mileage test point. The second level of in-use testing, known as ''in-use confirmatory testing'', would be performed on ''properly maintained and used'' vehicles and could be used to determine the need for recall. The preambles of the July 23, 1998, CAP 2000 proposed rule and the May 4, 1999, CAP 2000 final rule provide further discussion of these and other aspects of the CAP 2000 program.

b. Proposed Modifications to the CAP 2000 Program for Chassis-Based HDVs

In the development of the CAP 2000 proposal for chassis-based HDVs, EPA considered several issues and possible modifications to the light-duty vehicle CAP 2000 program. These issues are discussed below.

First, EPA proposes that the ''heavy-as-light'' provision in the current regulations (*see* 40 CFR 86.001–01(b) and 40 CFR 86.1801(c)(1)) would be available through the 2003 model year; starting with the 2004 model year, the ''heavy-as-light'' provision would no longer be available. EPA's ''heavy-as-light'' provision permits a manufacturer to certify a HDV of 14,000 pounds GVWR or less in accordance with the light-duty truck provisions. In effect, this provision allows manufacturers to certify these HDVs on a chassis dynamometer rather than on an engine dynamometer, as long as the HDVs comply with the more stringent light-duty truck standards. Today's action obviates the ''heavy-as-light'' provision after the 2003 model year. EPA is also proposing new provisions that would allow manufacturers flexibilities in grouping vehicles into test groups, as well as provisions allowing manufacturers to certify incomplete HDVs under the chassis-based HDV program.

Second, manufacturers have requested the ability to group vehicles from different test weight categories into the same test group for compliance purposes. For example, manufacturers would like the flexibility to group HDVs with LDT3s or LDT4s, or to group HDVs above and below 10,000 pounds GVWR together, for compliance purposes. In the light-duty CAP 2000 program, vehicles must be subject to the same emission standards to be grouped into the same test group (*see* 40 CFR 86.1827(a)(5)). However, EPA believes it is reasonable to allow manufacturers to voluntarily certify to more stringent standards. EPA is today proposing to allow manufacturers to request that vehicles from different weight categories be grouped together in the same test group, as long as the vehicles are then subject to the most stringent standards that would be applicable to any vehicles within that grouping. Voluntary certification to the more stringent emission standards means that the manufacturer would be subject to enforcement against the more stringent standards. EPA requests comment on the proposal to remove the ''heavy-as-light'' provision after the 2003 model year, the proposal to allow manufacturers to request to certify incomplete HDVs under the chassis-based HDV program, and the proposal that manufacturers be allowed to request that vehicles from different weight categories, which might be subject to different standards, be grouped together in one test group meeting the most stringent set of standards.

Third, in discussions about the application of CAP 2000 to chassis-based HDVs, manufacturers have questioned whether the light-duty ''AMA'' cycle would be allowed for durability testing.[70] In response, EPA is proposing that the AMA cycle would not be available as a durability procedure for chassis-based HDVs. (The CAP 2000 program likewise disallows the AMA durability procedure, but does allow for the carryover of AMA-based deterioration factors.) This proposal differs from the light-duty CAP 2000 program, in which under certain conditions the AMA cycle would be accepted during a transition period of three years, until the 2004 model year.[71] This transition period is reasonable for the light-duty CAP 2000 program, given that the light-duty compliance program had traditionally rested on use of the AMA cycle for durability demonstrations, and also that the use of the AMA cycle data is limited to the use of existing data generated for a 2000 model year or earlier certification (CAP 2000 requires that all new exhaust durability data be generated according to a manufacturer durability procedure approved by EPA). Manufacturers have long identified the AMA durability process as very costly and requiring extensive lead time for completion. EPA has been concerned about the ability of any fixed cycle, including the AMA cycle, to accurately predict in-use deterioration for all vehicles. In fact, EPA has particular concerns that the AMA does not represent the driving patterns of today and does not appropriately age current design vehicles. As a result, EPA believes that the AMA may have become outdated.[72]

Based on these concerns and also the fact that today's proposal includes provisions for averaging, banking and trading credits across test groups (in which FELs would be set based on durability procedures that would need to be comparable across test groups), EPA is proposing that the AMA cycle would not be automatically available as a durability procedure for chassis-based HDVs, unless a manufacturer were able to obtain approval for it. As in the light-duty CAP 2000 program, to obtain approval for a durability process, EPA is proposing to require that manufacturers provide data showing that the aging procedures would predict the deterioration of the significant majority of in-use vehicles over the breadth of their product line which would ultimately be covered by this procedure. This demonstration would be more than simply matching the average in-use deterioration; manufacturers would need to demonstrate to EPA's satisfaction that their durability processes would result in the same or more deterioration than is reflected by the in-use data for a significant majority of their vehicles. This approval process is the same as that already established for EPA's first phase of the light-duty revised durability program (RDP-I).[73] EPA requests comment on the proposal to not automatically allow the use of the AMA cycle for chassis-based HDVs.

Fourth, manufacturers have expressed several concerns about in-use testing for chassis-based HDVs, including potential difficulties in procuring vehicles for testing given the commercial use of many of these vehicles, and the appropriateness of in-use confirmatory testing for HDVs.[74] EPA believes that the provisions of the light-duty CAP 2000 program, when extended to chassis-

[70] See Item # IV–E–24 in EPA Air Docket #A–95–27. The ''AMA cycle'' is a part of EPA's standard light-duty durability process prior to CAP 2000, which requires manufacturers to accumulate mileage on a pre-production vehicle over a prescribed mileage accumulation driving cycle, specified in 40 CFR Part 86 (commonly referred to as the ''AMA cycle''), for 100,000 miles to simulate deterioration over the useful life of the vehicle.

[71] This is limited to only those products which qualify for carryover. New engine designs may not use the AMA carryover option.

[72] See the CAP 2000 NPRM (63 FR 39659, July 23, 1998) and Final Rule (64 FR 23913).

[73] In RDP-I manufacturers have typically shown that their durability programs cover ninety percent or higher of the distribution of deterioration rates experienced by vehicles in actual use. See EPA's guidance letter CD–94–13 dated July 29, 1994, available for review in the public docket.

[74] See Item #IV–E–24 in EPA Air Docket #A–95–27.

based HDVs, are sufficient to address manufacturer concerns about possible difficulties in procuring vehicles for in-use testing. If a manufacturer or a manufacturer's test group qualifies for in-use testing under a small volume sampling plan, there may be no in-use testing requirements (for volumes up to 5000), or as few as two tests per test group (for volumes up to 15,000); also, vehicles for testing may be owned by or under the control of the manufacturer (as opposed to being procured form customers) (*see* 40 CFR 86.1838–01(c)). In addition, if any manufacturer believes it is unable to procure the test vehicles necessary to test the required number of vehicles in a test group, the manufacturer may request a smaller sample size for any test group, subject to advance EPA approval (*see* 40 CFR 86.1845–01(c)(3)). EPA requests comment on the proposed provisions of the HDV CAP 2000 program regarding procuring vehicles for in-use testing.

Manufacturers have also suggested that it would be desirable to have a transition to the in-use confirmatory testing requirements over a period of years, as was available in the light-duty vehicle CAP 2000 program, rather than requiring this testing in the same year that the chassis-based certification and in-use verification testing requirements go into effect.[75] EPA is proposing that in-use confirmatory testing would be required for chassis-based HDVs. However, EPA believes that a delay in the in-use confirmatory testing requirements is appropriate in order to allow manufacturers to gain experience with chassis-based certification and in-use verification testing for chassis-based HDVs. Thus, EPA is proposing that the in-use confirmatory requirements would be applicable to vehicles produced starting with the 2007 model year. While manufacturers would not be required to conduct in-use confirmatory testing for vehicles produced prior to the 2007 model year, EPA would be fully prepared to investigate any high emissions indicated through manufacturer in-use verification testing or any other means. EPA requests comment on this proposal to require in-use confirmatory testing starting with the 2007 model year.

Finally, certain aspects of the light-duty CAP 2000 program, as contained in 40 CFR part 86, subpart S, would not apply to chassis-based HDVs, since EPA is not proposing requirements for HDVs in these areas at this time. These areas include provisions relating to intermediate useful lives, certification short test, cold temperature CO requirements, fuel economy programs, and supplemental FTP requirements.

In summary, EPA is proposing to extend the light-duty CAP 2000 program to chassis-based HDVs, with the following minor modifications. First, the option to certify HDVs under ''heavy-as-light'' provisions would no longer be available after the 2003 model year; instead, manufacturers could request to certify incomplete HDVs under the chassis-based HDV program. Second, manufacturers could request to group vehicles from different weight categories or subject to different standards into the same test group, provided that they meet the most stringent standards applicable to vehicles within that test group. Third, the AMA cycle would not automatically be available for HDVs as a durability procedure. Fourth, the in-use confirmatory testing requirement would be delayed for HDVs until the 2007 model year. Fifth, certain elements of the CAP 2000 program would not apply to chassis-based HDVs.

EPA requests comment on all aspects of this proposal for a chassis-based HDV compliance assurance program.

6. Useful Life

Currently, the useful life mileage interval for Otto-cycle HD engines is 8 years or 110,000 miles, whichever occurs first. The useful life for these vehicles in the California MDV program is 120,000 miles, which is also the useful life of heavy light-duty trucks. EPA proposes to adopt the useful life mileage interval of 120,000 miles for the HD Otto-cycle vehicles program. This approach allows consistency across the programs and is consistent with the use of the vehicles.

7. Aftermarket Alternative Fuels Conversions

There are companies that convert heavy-duty engines originally designed to run on conventional fuel to run on an alternative fuel. These engines are subject to EPA standards and the conversion manufacturers certify the converted engines. It is possible that some of these vehicles could be considered incomplete by the original manufacturer and certified to engine-based standards. However, when they reach the aftermarket conversion manufacturer, they may have the cargo carrying container attached and could be considered complete vehicles. In discussions with the conversion manufacturers they expressed a general preference for vehicle-based testing due to the greater availability of test facilities and lower costs. However, the conversion manufacturers raised concerns that it may be infeasible or unreasonable for them to test very large vehicles, those well over 10,000 pounds GVWR, on a chassis dynamometer due to lack of available test facilities designed to handle these very large vehicles.

EPA proposes the following two provisions for vehicles over 10,000 pounds GVWR. EPA proposes that aftermarket conversion manufacturers can choose to test vehicles that are originally designed and considered by the original manufacturer to be incomplete vehicles to either the engine or vehicle-based standards. In addition, aftermarket conversion manufacturers may certify complete vehicles to the engine-based standards due to the lack of available test facilities upon pre-approval from EPA. EPA requests comments on these proposed provisions.

F. Proposal To Revise the Definition of Light-Duty Truck

1. Background

In May of 1999, EPA proposed stringent new Tier 2 standards for passenger cars and light-duty trucks beginning in the 2004 model year (64 FR 26004, May 13, 1999). We are now in the process of analyzing the many public comments we received on the Tier 2 proposal. The proposed Tier 2 program would require all passenger cars and light-duty trucks to meet the same Tier 2 exhaust emissions standards by model year 2009. The phase-in of the standards would begin in 2004 with passenger cars and lighter light-duty trucks and end in 2009 when all light-duty trucks would be required to meet the standards. We proposed the same emissions standards for both cars and light-duty trucks because of the increased use of light-duty trucks primarily for personal transportation. The Tier 2 proposal did not contain any specific regulatory proposals for heavy-duty vehicles. We did, however, request comment on several options discussed in the proposal to prevent manufacturers from redesigning LDT4s so that they would fall into the heavy-duty vehicle category in order to avoid Tier 2 standards.[76]

We received several comments strongly supporting including all passenger vehicles in the Tier 2

[75] See Item # IV–E–24 in EPA Air Docket #A–95–27. On the light-duty side, some manufacturers had experience with in-use testing through the RDP-I in-use verification testing, starting as early as the 1994 model year.

[76] The LDT4 category contains the largest of the LDTs. The category includes LDTs with a gross vehicle weight greater than 6,000 pounds and an adjusted loaded vehicle weight of greater than 5,750 pounds.

program, regardless of vehicle weight. These commenters were very concerned that the Tier 2 standards would not apply to any vehicles above 8,500 pounds GVWR. Commenters believe that a number of these vehicles categorized by EPA as heavy-duty are primarily used as personal transportation much like their light-duty counterparts. Many commenters cited the new Ford Excursion sport-utility vehicle (SUV) as an example of a vehicle designed primarily for passenger transportation that would currently be classified as heavy-duty. Commenters also expressed concern that a significant difference in the standards for light-duty trucks and heavy-duty vehicles would encourage manufacturers to redesign vehicles to make them fit the definition of heavy-duty vehicles.

EPA also received comment stating that no heavy-duty vehicles should be included in the Tier 2 program. The Alliance of Automobile Manufacturers commented that full product line manufacturers currently offer light-duty and heavy-duty versions of vehicles such as pickups and vans and would not want to create a product void in the LDT4 market segment. They further commented that manufacturers would refrain from changing their vehicles in ways that would increase cost and decrease performance and marketability. Commenters also noted that heavy-duty vehicles are designed for a broad range of purposes. They are designed to be heavier, stronger, and more durable and it would be impossible for such vehicles to meet light-duty emissions standards, claimed some commenters.

After carefully considering all of the comments, we believe both general perspectives have merit depending on the type of vehicle being considered. A small minority of sales in the complete heavy-duty vehicle category consist of vehicles that are more clearly designed for personal use, such as SUVs and passenger vans. All of these vehicles are below 10,000 pounds GVWR. In addition, we are concerned that there will be an increase in new vehicle offerings marketed primarily for passenger transportation in this market segment in the future. As personal use passenger vehicles, they would be more likely to be used as personal transportation and operated under lightly loaded conditions more of the time. We propose that these passenger vehicles (both gasoline and diesel fueled) be included in the Tier 2 program, tested as light-duty trucks, and held to Tier 2 standards. The following sections provide our detailed proposal to capture these vehicles in the Tier 2 framework and provides an overview of the Tier 2 emissions standards that would apply.

For the remaining vehicles in the heavy-duty category (primarily traditional large pickup trucks, cargo vans, and incomplete vehicles), we continue to believe the heavy-duty standards and test procedures proposed in this rulemaking are most appropriate. Heavy-duty vehicles would be tested under more heavily loaded conditions compared with light-duty trucks in Tier 2. Considering this difference in test conditions, we believe that the heavy-duty vehicle standards we are proposing in this rule for 2004 would be similar in stringency to the Tier 2 standards that have been proposed for light-duty trucks in this time frame.

In addition, we are considering the need for more stringent heavy-duty vehicle standards for 2007 and later model years, as discussed in section X.C of this preamble.

2. Proposal

As noted above, we believe it is appropriate to consider including certain vehicles currently classified as heavy-duty vehicles in the proposed light-duty Tier 2 program. In order to accomplish this objective, the proposed regulations include a revised definition of ''light-duty truck'' designed to bring large models of SUVs and passenger vans into the proposed Tier 2 program. The proposed regulations also contain a parallel revision to the definition of ''heavy-duty vehicle'' in order to prevent an overlap in the vehicles covered by the two definitions.

Specifically, the proposed definition of light-duty trucks seeks to include the targeted vehicles by stating that a light-duty truck, in addition to those vehicles that meet the current definition, is also any complete vehicle between 8,500 and 10,000 pounds GVWR that is designed primarily for personal transportation and has a capacity of up to 12 persons. We expect that the proposed definition would exclude vehicles that have been designed for a legitimate work function as their primary use, such as the largest pick-up truck, the largest passenger vans, and cargo vans; these vehicles would continue to be categorized as heavy-duty and would be subject to applicable heavy-duty standards. However, we request comment on whether the proposed definition adequately excludes these vehicles, or whether additional criteria may be needed. If additional criteria are believed to be needed, we request comment on how such criteria might be used (i.e., what are appropriate cut points). For example, the definition could include the use of factors such as whether the vehicle's body is fully or almost fully enclosed (i.e., there is no significant exterior cargo space such as there is on a pick-up truck), the portion of the total payload that might be consumed by vehicle passengers, the portion of available chassis space consumed by passenger seating, the percent of the total GVWR comprised of the vehicle's curb weight, or other relevant factors. We believe that this definition will capture SUVs, such as the Chevrolet Suburban and the Ford Excursion, and bring them into the proposed Tier 2 program. Table 5 identifies the currently produced vehicles that we believe would be subject to the Tier 2 program according to the revised definition of light-duty truck.

TABLE 5.—PASSENGER VEHICLES BETWEEN 8,500 AND 10,000 POUNDS GVWR

Vehicle	Vehicle type	Manufacturer
Suburban	SUV	GM.
Excursion	SUV	Ford.
Express Wagon (G2500 and G3500)	Passenger van	GM.
Dodge Ram Wagon 3500	Passenger van	Daimler Chrysler.
Econoline Super-duty Wagon (E250 and E350)	Passenger van	Ford.

Vehicles meeting the proposed additional element to the light-duty truck definition would be classified as heavy light-duty trucks (HLDTs) according to definitions that already exist in the regulations, and therefore would be subject to the standards in EPA's proposed Tier 2 program.[77] The

[77] LDT3 and LDT4s are considered heavy light-duty trucks (HLDTs).

specifics of how these vehicles would be folded into the Tier 2 program are described below.

3. Integration Into Proposed Tier 2 Program

a. Tier 2 Standards for New HLDTs

We propose that for 8,500–10,000 pound GVWR vehicles covered under the revised definition of light-duty trucks discussed above, these vehicles would meet the same standards as the LDT3 and LDT4 vehicles in Tier 2, that is, this new category of vehicles would be part of the Tier 2 heavy-light duty truck program. That program is discussed in detail in the Tier 2 proposal, and will only be summarized here. The reader should review the entire Tier 2 proposal to gain a full understanding of the Tier 2 program for HLDTs. The new HLDTs covered by the proposed change in definition would be averaged in with a manufacturers' LDT3s and LDT4s so that 50 percent of the HLDTs would meet Tier 2 standards in 2008, and 100 percent would have to meet Tier 2 standards in 2009. As Tier 2 vehicles, these large SUVs and passenger vans would be included with other HLDTs in meeting the 0.07 g/mi average NO_X standard in 2008. In 2009, they would be included with all Tier 2 LDVs and LDTs in meeting the 0.07 g/mi NO_X average standard (see Table 6).

BILLING CODE 6560–50–P

Table 6.—Tier 2 and Interim Non-Tier 2 Phase-in and Exhaust Averaging Sets (Bold lines around shaded areas indicate averaging sets)

	2001	2002	2003	2004	2005	2006	2007	2008	2009 & later	NOx STD. (g/mi)
LDV/LLDT (INTERIM)	NLEV	NLEV	NLEV	75% max.	50% max.	25% max.				0.30 avg
LDV/LLDT (TIER 2 +evap)	*early banking* b	b	b	25%	50%	75%	100%	100%	100%	0.07 avg
HLDT (TIER 2 +evap)	b, c	b, c	b, c	*early banking* b	b	b	b	50%	100%	0.07 avg
HLDT (INTERIM)	TIER 1 b, c	TIER 1 b, c	TIER 1 b, c	25%	50%	75%	100%	50% max.		0.20[a] avg

BILLING CODE 6560–50–C

[a] 0.60 NO_X cap applies to balance of vehicles during the 2004–2006 phase-in years.
[b] Alternative phase-in provisions permit manufacturers to deviate from the 25/50/75% 2004–2006 and 50% 2008 phase-in requirements and provide credit for phasing in some vehicles during one or more of these model years.
[c] HLDT vehicles between 8,500 and 10,000 pound GVWR will be meeting the 1998 Heavy-duty standards during this time frame.

As described in the Tier 2 proposal, manufacturers would meet the Tier 2 NO_X standard by certifying to one of seven emission bins, and using averaging to meet the corporate average NO_X standard of 0.07 g/mi. The proposed Tier 2 exhaust emission standards for all bins are shown in Table 7 and Table 8.

TABLE 7.—TIER 2 LIGHT-DUTY FULL USEFUL LIFE (120,000 MILE) EXHAUST EMISSION STANDARDS

[Grams per mile]

Bin No.	NO_X	NMOG	CO	HCHO	PM
7	0.20	0.125	4.2	0.018	0.02
6	0.15	0.090	4.2	0.018	0.02
5	0.07	0.090	4.2	0.018	0.01
4	0.07	0.055	2.1	0.011	0.01
3	0.04	0.070	2.1	0.011	0.01
2	0.02	0.010	2.1	0.004	0.01
1	0.00	0.000	0.0	0.000	0.00

TABLE 8.—TIER 2 LIGHT-DUTY INTERMEDIATE USEFUL LIFE (50,000 MILE) EXHAUST EMISSION STANDARDS

[Grams per mile]

Bin No.	NO_X	NMOG	CO	HCHO	PM
7	0.14	0.100	3.4	0.015	....
6	0.11	0.075	3.4	0.015	....
5	0.05	0.075	3.4	0.015	....
4	0.05	0.040	1.7	0.008	....

b. Interim Standards for New HLDTs

Between 2004 and 2007, these new HLDT vehicles would have two options; to participate in early banking for the Tier 2 program, or be part of the Tier 2 HLDT Interim program along with LDT3 and LDT4 vehicles. The early banking option is described in detail for HLDT in the Tier 2 proposal.

The Interim program proposed in Tier 2 phases in between 2004 and 2007 (see Table 6). Our interim standards for HLDTs would begin in 2004. The Interim Program for HLDTs would set a corporate average NO_X standard of 0.20 g/mi that would be phased in between 2004 and 2007. The interim HLDT standards, like those for Tier 2 LDV/LLDTs would be built around a set of bins (see Tables 9 and 10). As shown in Table 6, the phase-in would be 25 percent in the 2004 model year, 50 percent in 2005, 75 percent in 2006, and 100 percent in 2007. The program would remain in effect through 2008 to cover those HLDTs not yet phased into the Tier 2 standards (a maximum of 50%). Vehicles not subject to the interim corporate average NO_X standard during the 2004–2006 phase-in years would be subject to the least stringent bin (Bin 5) so their NO_X emissions would be effectively capped at 0.60 lg/mi. These vehicles would be excluded from the calculation to determine compliance with the interim 0.20 g/mi average NO_X standard.

TABLE 9.—FULL USEFUL LIFE (120,000 MILE) INTERIM EXHAUST EMISSION STANDARDS FOR HLDTS

[Grams per mile]

Bin No.	NO_X	NMOG	CO	HCHO	PM
5	0.60	0.230	4.2	0.018	0.06
4	0.30	0.180	4.2	0.018	0.06
3	0.20	0.156	4.2	0.018	0.02
2	0.07	0.090	4.2	0.018	0.01
1	0.0	0.00	0.0	0.000	0.0

TABLE 10.—INTERMEDIATE USEFUL LIFE (50,000 MILE) INTERIM EXHAUST EMISSION STANDARDS FOR HLDTS

[Grams per mile]

Bin No.	NO_X	NMOG	CO	HCHO	PM
5	0.40	0.160	3.4	0.015	....
4	0.20	0.140	3.4	0.015	....
3	0.14	0.125	3.4	0.015	....
2	0.05	0.075	3.4	0.015	....

All other aspects of the Tier 2 proposal which covers HLDT vehicles would apply to those 8,500–10,000 pound GVWR vehicles classified as HLDTs according to the proposed definition described above. The reader is encouraged to examine the Tier 2 proposal for a full description of these provisions.

c. Technological Feasibility of Tier 2 Standards for New HLDTs

As discussed above, we believe this new definition of HLDTs between 8,500 and 10,000 pounds will capture vehicles designed for personal transportation purposes, principally sport-utility vehicles and passenger vans. Cargo vans and traditional pickups would not be classified as HLDTs by this new definition. Table 11 represents our estimates of the number of 8,500–10,000 pound GVWR vehicles which would be covered by the proposed revision to the light-duty truck definition, as well as sales estimates for the LDT3s and LDT4s which currently comprise the HLDT category.

TABLE 11.—EPA'S ESTIMATED 1998 SALES OF LDT3, LDT4, AND NEW HLDT VEHICLES BETWEEN 8,500 AND 10,000 POUNDS GVWR

	LDT3 and LDT4	New HLDTs between 8,500 and 10,000 pound GVWR
Gasoline Vehicle Sales	1.5 million	<70,000
Diesel Vehicle Sales	<1 percent of gasoline LDT3 and LDT4 sales	<5,000

As can be seen in Table 11, the revision of the LDT definition proposed today would increase the total number of HLDT vehicles by less than 5 percent. The proposed change in the definition of light-duty trucks would result in the diesel fraction being less than 0.5 percent of all HLDTs.

These new HLDT vehicles are similar in engine design to existing LDT4 vehicles, and we believe the technological feasibility arguments contained in the Tier 2 proposal apply to these vehicles as well. In addition to these arguments, Tables 3–9 in the draft RIA for this proposal contains a list of 1998 and 1999 model year gasoline vehicles certified to the California Medium Duty Vehicle program (using low sulfur California fuel). In the 8,500 to 10,000 pound GVWR range, a number of engine families have full useful life (120,000 miles) NO_X emissions in the 0.2 to 0.6 g/mile range, and a few families are certified in the 0.1 to 0.3 g/mile NO_X range. These vehicles are all tested at curb weight plus half-payload, while those captured by the new definition would be tested at curb weight plus 300 pounds, a less stringent test condition. Therefore, a large number of gasoline engine families between 8,500 and 10,000 are already capable of meeting the highest bin under the Tier 2 Interim program (0.6 g/mile), and a few are approaching the Tier 2 NO_X standard of 0.07 g/mile, and are within the highest NO_X bin under Tier 2 (0.2 g/mile NO_X). In addition, compared to the number of existing LDT3 and LDT4 vehicles, the number of vehicles captured by the new HLDT definition are relatively small (< 5 percent), and the averaging program proposed for Tier 2 will provide manufacturers with considerable lead time for applying control technology to these vehicles.

As noted above, these new HLDTs are similar in their engine types and designs to existing LDT4 vehicles, and because of this we expect that these new HLDTs will employ essentially the same types of technologies as existing LDT4 vehicles to meet EPA's proposed Tier 2 standards. Similarly, the costs EPA projected for bringing existing LDT4 vehicles into compliance with the Tier 2 standards can also be carried over to these new HLDTs. These costs are discussed in detail in EPA's proposal for Tier 2 standards, and the reader is urged to refer to that discussion for more information (see 64 FR 26070, May 13, 1999). EPA estimates that bringing these new HLDTs under the Tier 2 program would cost $270 per vehicle, i.e., the same as for other LDT4s. Based on an estimate of approximately 75,000 vehicles affected, annual costs would equal about $20 million when the program is fully phased-in by 2009. Per vehicle NO_X emission reductions of 4.3 g/mi would be expected from the current standards. This is a significantly larger per vehicle reduction than expected for current LDT4s, so EPA anticipates the near term cost effectiveness would be more cost effective. We request comment on the application of these cost estimates to the vehicles that would be covered by the proposed change to the LDT definition. This issue will be analyzed more carefully as part of the final rulemaking.

As outlined above, Tier 2 standards are intended to be ''fuel neutral.'' Under the principle of fuel neutrality, all cars and light trucks, including those using diesel engines, would be required to meet the proposed Tier 2 standards. EPA believes that the proposed program, including the phase-in periods, would facilitate the advancement of clean diesel engine technologies. EPA further believes that in the long term the standards would be within reach for diesel-fueled vehicles in combination with appropriate changes to diesel fuel to facilitate aftertreatment technologies.

As discussed in the Tier 2 proposal, the emission reduction technology needed to meet these levels for a diesel HLDT would likely require advanced diesel aftertreatment devices, such as NO_X absorbers and PM traps. These technologies have the potential to provide emission reductions approaching 90 percent or greater. Considering the long lead time available to manufacturers, we believe these standards may be feasible for diesel HLDTs, including the vehicles that would be captured by the proposed change to the definition. In addition, the number of diesel powered vehicles between 8,500 and 10,000 pounds GVWR which would be classified as HLDTs by the proposed new definition is very small, as shown in Table 11. The total number of diesel HLDTs (including LDT3 and LDT4) would be less than 0.5 percent of all HLDTs. Averaging will likely provide the manufacturer with additional flexibility to meet both the interim and final Tier 2 standards.[78]

Considering all of these factors (long lead time, averaging program, similarity to LDT3s and LDT4s, and existing certification data) , we believe that these new HLDT vehicles will be able to meet the Tier 2 interim standards and the Tier 2 final standards. As discussed above, the number of these vehicles, compared to the existing LDT3 and LDT4 fleet, is relatively small, and averaging will likely provide the manufacturer with the needed flexibility to meet both the interim and final Tier 2 standards. The conclusion of all of our analyses is that the proposed Tier 2 standards for this new category of HLDT vehicles would be feasible for gasoline-fueled vehicles operated on low-sulfur gasoline. As gasoline-fueled vehicles represent the overwhelming majority of the HLDT population (>99.5 percent), including those covered by the proposed change in the HLDT definition, EPA proposes to find that the proposed standards would be feasible overall for HLDT vehicles.

The Agency is considering adding a bin for HLDTs greater than 8,500 pounds GVWR for the 2004 thru 2008 model year time frame. This interim bin would not be available in 2009 and beyond once the Tier 2 standards are fully phased-in. This approach would create an appropriate opportunity for flexibility during the phase-in years. We believe that appropriate standards for an interim bin for HLDTs above 8,500 pounds GVWR are the existing California Medium Duty Vehicle LEV–I standards for this category of vehicles (0.9 and 0.12 g/mile for NO_X and PM, respectively). Under this proposal, these chassis-based standards would already be in place for the heavy-duty vehicles between 8,500 and 10,000 pounds GVWR that would not be classified as HLDTs (see section IV.E). In addition, manufacturers would already be meeting these standards in California, and could carry over California vehicles to the federal program. We request comment on whether such an approach should be pursued in the final rule.

We request comment on all aspects of this proposed change in the definition of HLDTs, and the inclusion of these HLDTs in the Tier 2 program. We specifically seek comments on the appropriateness of the 10,000 pound GVWR limit as the upper cap for this program and on the technological feasibility of the standards being proposed for these passenger vehicles. After considering all comments received on this proposed change in the definition of HLDTs, it is our intention to finalize a change in the definition of LDTs in the Tier 2 final rule, if timing permits. If this is deemed infeasible, we would likely finalize this provision in the final rule for the heavy-duty 2004 standards. The Agency requests that any comments on this specific issue be sent to the dockets for both this rulemaking and the Tier 2 rulemaking, A–97–10 (See Section XI for information on how to provide written comments on this rule).

G. On-Board Diagnostics

Today's notice also contains proposed requirements for on-board diagnostic systems on heavy-duty vehicles and engines up to 14,000 pounds GVWR, both Otto-cycle and diesel. The proposed OBD requirements are essentially equivalent to those already in place for light-duty vehicles and

[78] We generally expect that manufacturers would take advantage of the flexibilities in the Tier 2 proposal to delay the need for diesel vehicles to meet the final Tier 2 levels until late in the phase-in period. Because diesel vehicles represent a very small percentage of the LDT market, diesel LDTs would not fall under the final Tier 2 standards until 2009, giving manufacturers a relatively large amount of leadtime. As noted in the Tier 2 proposal, some new diesel aftertreatment options may require lower sulfur diesel fuel than is currently available. We have issued an Advance Notice of Proposed Rulemaking intended to solicit comment on the need for reduced sulfur in diesel fuel in order to meet these standards. We also believe that the proposed interim standards would be feasible for diesels by 2004, with or without the fuel change, given the flexibilities associated with those standards.

trucks,[79] including the optional provision that allows demonstration of compliance with California OBDII requirements [80] as a means of satisfying today's federal OBD requirements. The Agency is proposing to include OBD requirements in today's notice because OBD systems help ensure continued compliance with emission standards during in-use operation, and they help mechanics to properly diagnose and repair malfunctioning vehicles while minimizing the associated time and effort. The codification of OBD system requirements would also allow for potential inclusion of heavy-duty vehicles and engines in inspection/maintenance programs via a simple check of the OBD system.

1. Background on OBD

Section 202(m) of the CAA, 42 U.S.C. 7521(m), directs EPA to promulgate regulations requiring 1994 and later model year LDVs and LDTs to contain an OBD system that monitors emission-related components for malfunctions or deterioration ''which could cause or result in failure of the vehicles to comply with emission standards established'' for such vehicles. Section 202(m) also states that EPA may require such OBD systems for heavy-duty vehicles and engines.

On February 19, 1993, EPA published a final rule requiring manufacturers of light-duty applications to install such OBD systems on their vehicles beginning with the 1994 model year (*see* 58 FR 9468, February 19, 1993). The OBD systems must monitor emission control components for any malfunction or deterioration that could cause exceedance of certain emission thresholds. The regulation also requires that the driver be notified of any need for repair via a dashboard light, or malfunction indicator light (MIL), when the diagnostic system detects a problem. EPA also allows optional compliance with California's second phase OBD requirements, referred to as OBDII (13 CCR 1968.1), for purposes of satisfying the EPA OBD requirements.

Since publishing the 1993 OBD final rule, EPA has made several revisions to the OBD requirements. On March 23, 1995, EPA published a direct final rule that served largely to create more consistency between the California OBDII requirements and the EPA OBD requirements (*see* 60 FR 15242, March 23, 1995). The March 1995 rule also put into place deficiency provisions for EPA OBD systems that allowed for certification despite the presence of minor noncompliances that could not be resolved within the time constraints of production schedules. On August 30, 1996, EPA published another final rule to allow optional compliance with California's newly revised OBDII requirements (61 FR 45898). On December 22, 1998, EPA published a final rulemaking that achieved even further consistency with the California OBDII requirements (*see* 63 FR 70681, December 22, 1998). This recent final rulemaking results in essentially identical emission malfunction thresholds and identical component monitoring requirements as required by the California OBDII regulation.

However, none of these federal rules extended OBD requirements to heavy-duty vehicles and engines. Today's action proposes that the existing light-duty OBD provisions be broadened to include both Otto-cycle and diesel heavy-duty vehicles and engines up to 14,000 pounds GVWR. EPA is also proposing some revisions to existing light-duty OBD requirements applicable to diesel vehicles and trucks. These light-duty revisions are being proposed to maintain consistency across the existing light-duty diesel OBD requirements and today's proposed heavy-duty diesel OBD requirements.

The Agency believes it is appropriate to extend OBD requirements to include heavy-duty vehicles and engines for many reasons. In the past, heavy-duty diesel engines have relied primarily on in-cylinder modifications to meet emission standards. For example, emission standards have been met through changes in injection timing, piston design, combustion chamber design, use of four valves per cylinder rather than two valves, and piston ring pack design and location improvements. In contrast, the 2004 standards represent a significant technological challenge, and while manufacturers may make engine design changes to comply with those standards, EPA expects the 2004 standards will require EGR. Such ''add on'' devices can experience deterioration and malfunction that, unlike the engine design elements listed earlier, may go unnoticed by the driver. Because deterioration and malfunction of these ''add-on'' devices can go unnoticed by the driver, and because their sole purpose is emissions control, some form of detection is crucial. The Agency believes that such detection can be effectively achieved by employing a well designed OBD system.

The same argument is true for Otto-cycle heavy-duty vehicles and engines. While emission control is managed both with engine design elements and ''add-on'' devices, the ''add-on'' devices, particularly the catalytic converter, are the primary emission control features. The Agency believes it is critical that the emission control system, particularly the ''add-on'' type systems, be monitored for proper operation to ensure that new vehicles and engines certified to the standards proposed today continue to meet those standards throughout their full useful life.

Further, the industry trend is clearly toward increasing use of computer and electronic controls for both engine and powertrain management, and for emission control. In fact, the heavy-duty industry has already gone a long way, absent any government regulation, to standardize computer communication protocols.[81] Computer and electronic control systems, as opposed to mechanical systems, provide improvements in many areas including, but not limited to, improved precision and control, reduced weight, and lower cost. However, electronic and computer controls also create increased difficulty in diagnosing and repairing the malfunctions that inevitably occur in any engine or powertrain system. Today's proposed OBD requirements would build on the efforts already undertaken by the industry to ensure that key emission related components will be monitored in future heavy-duty vehicles and engines and that the diagnosis and repair of those components will be as efficient and cost effective as possible.

For these reasons, most manufacturers of vehicles, trucks, and engines have incorporated OBD systems that are capable of identifying when malfunctions occur, and in what systems. In the heavy-duty industry, those OBD systems traditionally have been geared toward detecting malfunctions causing driveability and/or fuel economy related problems. Without specific requirements for manufacturers to include OBD mechanisms to detect emission-related problems, those types of malfunctions that could result in high emissions without a corresponding adverse driveability or fuel economy impact could go unnoticed by both the driver and the repair technician. The resulting increase in emissions and detrimental impact on air quality could be avoided by incorporating an OBD system capable of detecting emission control system malfunctions.

[79] See 40 CFR 86.099–17; 40 CFR 86.1806–01.

[80] *See, e.g.,* Title 13, California Code of Regulations (CCR) §1968.1, as modified pursuant to California Mail Out #97–24 (December 9, 1997).

[81] See ''On-Board Diagnostics, A Heavy Duty Perspective,'' SAE 951947, and, ''Recommended Practice for a Serial Control and Communications Vehicle Network,'' SAE J1939.

2. CARB OBDII Requirements

Current EPA OBD requirements apply only to light-duty vehicle and light-duty truck categories (less than 8500 pounds GVWR). In contrast, the CARB OBDII requirements include all light-duty categories and the CARB medium-duty category (vehicles/engines up to 14,000 pounds GVWR). As a result, while manufacturers of trucks and engines in the 8500 to 14,000 pound GVWR category have not certified federally to OBD regulations, they have certified to the CARB OBDII requirements on all their California applications beginning with the 1996 model year.[82]

Furthermore, while these manufacturer's federal certification applications have not covered OBD requirements, the trucks and engines nonetheless contain OBD systems with varying levels of sophistication. This appears to be particularly true for diesel applications.[83] While the sophistication of some of the OBD systems on existing federally certified heavy-duty vehicles and engines may be less than that required by today's proposal, EPA believes that the development work and lessons learned during implementation of CARB OBDII systems in California can be readily transferred to federal applications. With today's action, EPA proposes to implement OBD requirements for heavy-duty vehicles nationwide so that the benefits of OBD can be realized not only in California, but in the remaining 49 states as well.

3. Proposed Federal OBD Requirements

Today's proposed OBD requirements are discussed in detail below. The requirements for heavy-duty Otto-cycle vehicles and engines are identical to those already in place for light-duty Otto-cycle vehicles and trucks. However, the proposed OBD requirements for heavy-duty diesel vehicles and engines differ somewhat from the current light-duty diesel requirements, specifically with regard to engine misfire and aftertreatment monitoring requirements. As a result, and because the Agency believes that the diesel provisions proposed today are more appropriate for diesel applications, today's notice also proposes that the light-duty diesel requirements be revised to be consistent with today's proposed heavy-duty diesel requirements.

In general, the OBD system must monitor emission-related powertrain components for deterioration or malfunction causing emissions to exceed 1.5 times the applicable standards. Upon detecting a malfunction, a dashboard MIL must be illuminated informing the driver of the need for repair. To assist the repair technician in diagnosing and repairing the malfunction, the OBD system must also incorporate standardization features (e.g., the diagnostic data link connector; computer communication protocols; etc.) the intent of which is to allow the technician to diagnose and repair any OBD compliant truck or engine through the use of a ''generic'' hand-held OBD scan tool.

4. Federal OBD Malfunction Thresholds and Monitoring Requirements

EPA proposes that, beginning in the 2004 model year, heavy-duty vehicles and engines must be equipped with an OBD system capable of detecting and alerting the driver of the following emission-related malfunctions or deterioration as evaluated over the appropriate certification test procedure:[84]

(a) Catalyst or particulate trap deterioration or malfunction:

Otto-cycle—before it results in an increase in NMHC[85] emissions equal to or greater than 1.5 times the NMHC standard or FEL, as compared to the NMHC emission level measured using a representative 4000 mile catalyst system; for engine certified systems, $NMHC+NO_X$ would be used in place of NMHC.

Diesel-cycle—before it results in exhaust emissions exceeding 1.5 times the applicable standard or FEL for NO_X or PM. This monitoring would not need to be done if the manufacturer can demonstrate that deterioration or malfunction of the system will not result in exceedance of the threshold; however, the presence of the catalyst or particulate trap must still be verified. For engine certified systems, $NMHC+NO_X$ would be used in place of NO_X.

(b) Engine misfire:

Otto-cycle—before it results in an exhaust emission exceedance of 1.5 times the applicable standard or FEL for NMHC, CO or NO_X; for engine certified systems, this would be 1.5 times $NMHC+NO_X$ or CO.

Diesel-cycle—when lack of combustion occurs.

(c) If the vehicle or engine contains an oxygen sensor, then oxygen sensor deterioration or malfunction before it results in an exhaust emission exceedance of 1.5 times the applicable standard or FEL for NMHC, CO or NO_X; for engine certified systems, this would be 1.5 times $NMHC+NO_X$ or CO.

(d) If the vehicle or engine contains an evaporative emission control system, then any vapor leak in the evaporative and/or refueling system (excluding the tubing and connections between the purge valve and the intake manifold) greater than or equal in magnitude to a leak caused by a 0.040 inch diameter orifice; an absence of evaporative purge air flow from the complete evaporative emission control system. On vehicles with fuel tank capacity greater than 25 gallons, the Administrator would be required to revise the size of the orifice to the feasibility limit, based on test data, if the most reliable monitoring method available was unable to reliably detect a system leak equal to a 0.040 inch diameter orifice.

(e) Any deterioration or malfunction occurring in a powertrain system or component directly intended to control emissions, including but not necessarily limited to, the EGR system, if equipped, the secondary air system, if equipped, and the fuel control system, singularly resulting in exhaust emissions exceeding 1.5 times the applicable emission standard or FEL for NMHC, CO, NO_X, or diesel PM. For vehicles equipped with a secondary air system, a functional check, as described in paragraph (f) below, may satisfy the proposed requirements of this paragraph provided the manufacturer can demonstrate that deterioration of the flow distribution system is unlikely. This demonstration would be subject to Administrator approval and, if the demonstration and associated functional check are approved, the diagnostic system would be required to indicate a malfunction when some degree of secondary airflow is not detectable in the exhaust system during the check.

(f) Any other deterioration or malfunction occurring in an electronic emission-related powertrain system or

[82] This includes heavy-duty diesel and Otto-cycle applications which fall into EPA's light heavy- duty category.

[83] See ''On-Board Diagnostics, A Heavy Duty Perspective,'' SAE 951947; memo from T. Sherwood to Air Docket No. A–98–32, ''Documentation of Sophisticated On-board Diagnostic (OBD) Systems on Current Heavy-duty Diesel Engines, dated March 17, 1999; and Internet websites for various heavy-duty diesel engine manufacturers: www.cummins.com; www.detroitdiesel.com; www.navistar.com.

[84] The FTP minus the Supplemental FTP for chassis certified systems; the engine certification test procedure minus any supplemental test procedures for engine certified systems. While malfunction thresholds are based on certification test procedure emissions, this does not mean that OBD monitors need operate only during the test procedure. All OBD monitors that operate continuously during the test procedure should operate in a similar manner during non-test procedure conditions. The prohibition against defeat devices in §86.004–16 applies to these OBD requirements.

[85] As a point of clarification, federal emissions standards are expressed in terms of NMHC. Therefore, in order to remain consistent, all references to HC will be referred to as NMHC.

component not otherwise described above that either provides input to or receives commands from the on-board computer and has a measurable impact on emissions; monitoring of components required by this paragraph would be satisfied by employing electrical circuit continuity checks and, wherever feasible, rationality checks for computer input components (input values within manufacturer specified ranges based on other available operating parameters), and functionality checks for computer output components (proper functional response to computer commands); malfunctions would be defined as a failure of the system or component to meet the electrical circuit continuity checks or the rationality or functionality checks.

Upon detection of a malfunction, the MIL would be required to illuminate and a fault code stored no later than the end of the next driving cycle during which monitoring occurs provided the malfunction is again detected. Alternatively, upon Administrator approval, a manufacturer would be allowed to use a diagnostic strategy that employs statistical algorithms for malfunction determination (e.g., Exponentially Weighted Moving Averages (EWMA)). The Administrator considers such strategies beneficial for some monitors because they reduce the danger of illuminating the MIL falsely since more monitoring events are used in making pass/fail decisions. However, the Administrator would only approve such strategies provided the number of trips required for a valid malfunction determination is not excessive (e.g., six or seven monitoring events). Manufacturers would be required to determine the appropriate operating conditions for diagnostic system monitoring with the limitation that monitoring conditions are encountered at least once during the applicable certification test procedure or a similar test cycle as approved by the Administrator. This is not meant to suggest that monitors be designed to operate only under test procedure conditions, as such a design would not encompass the complete operating range required for OBD malfunction detection.

As an option to the above requirements, EPA proposes to allow compliance demonstration according to the California OBDII requirements. This option has been available to light-duty vehicles and trucks since the implementation of the federal OBD program. This option allows manufacturers to concentrate on one set of OBD requirements for nationwide implementation (although federal OBD emission malfunction thresholds and monitoring requirements are essentially equivalent to those of the California OBDII regulation) and provides the highest level of OBD system effectiveness toward meeting nationwide clean air goals.

However, there are differences between the California OBDII requirements and today's proposed EPA OBD requirements. The California OBDII regulation does not require catalyst or particulate trap monitoring for diesel-cycle vehicles and engines. Today's notice proposes such monitoring for EPA OBD systems. Therefore, if a manufacturer chooses the California OBDII compliance option for a diesel vehicle or engine, that manufacturer would still be required to satisfy the catalyst or particulate trap OBD monitoring requirements of today's proposal.

The Agency requests comment on the above proposed OBD system requirements, the emission threshold levels, and the California OBDII compliance option. The Agency also wants to highlight and request comment on a very minor change meant to clarify and define the meaning behind rationality checks on applicable monitors. With this proposal, reflected in paragraph (f) above, and sections 86.004–17(b)(6) and 86.1806–04(b)(6) of the proposed regulatory language, this definition would be changed from ''rationality checks for computer input components (input values within manufacturer specified ranges),'' to read, ''rationality checks for computer input components (input values within manufacturer specified ranges based on other available operating parameters).'' This proposed change would apply to all OBD systems—light-duty, heavy-duty, chassis certified, engine certified, Otto-cycle, diesel—and only serves to clarify; it would not constitute a new OBD requirement.

5. Proposed Standardization Requirements

The light-duty OBD regulations contain requirements for standardization of certain critical aspects of the OBD system. These critical aspects include the design of the data link connector, protocols for on-board to off-board computer communication, formats for diagnostic trouble codes, and types of test modes the on-board system and the off-board scan tool must be capable of supporting. Today's action proposes that these standards, tabulated below, also be required for heavy-duty OBD systems. Today's action also proposes that, as an alternative, manufacturers have the option of standardizing their systems according to SAE J1939, ''Recommended Practice for a Serial Controlled Communications Vehicle Network.'' This alternative standard, SAE J1939, is a standard developed by the Society of Automotive Engineers (SAE) specifically for heavy-duty applications.

PROPOSED STANDARDS FOR HEAVY-DUTY OBD SYSTEMS

Proposed standards [a]	Alternative proposed standards
SAE J1850: communications protocol	SAE J1939: communications protocol; data link connector; test modes and downloading protocols; format for diagnostics trouble codes.
ISO 9141–2: communications protocol	
SAE J1962: data link connector	
SAE J1979: test modes and downloading protocols	
SAE J2012: format for diagnostics trouble codes	

[a] SAE refers to the Society of Automotive Engineers; ISO refers to the International Organization of Standardization.

The Agency requests comment on the appropriateness of the above standards and the need to incorporate other standards not mentioned above.

6. Deficiency Provisions

Today's action proposes to apply the same deficiency provisions to heavy-duty OBD systems as currently apply to light-duty OBD systems. This would allow the Administrator to accept an OBD system as compliant even though specific requirements are not fully met. The deficiency provisions were first introduced on March 23, 1995 (60 FR 15242), and were recently revised on December 22, 1998 (63 FR 70681).

The Agency is proposing these deficiency provisions because, despite the best efforts of manufacturers, many will likely need to certify vehicles with some sort of deficiency when unanticipated problems arise that can not be remedied in time to meet production schedules. Given the considerable complexity of designing, producing, and installing the components and systems that make up the OBD system, manufacturers of light-duty vehicles and trucks have expressed and demonstrated difficulty in complying with every aspect of the OBD requirements. The same difficulty is expected for heavy-duty vehicles and engines. While we believe that 100 percent compliance can be achieved, we also believe that some sort of relief should be provided to allow for certification of engines that, despite the best efforts of the manufacturers, have deficient OBD systems.

The EPA "deficiency allowance" should only be seen as an allowance for minor deviations from the OBD requirements. In fact, EPA expects to implement this deficiency allowance primarily for software or calibration type problems, as opposed to cases where necessary hardware is at fault or is not present. EPA expects that manufacturers should have the necessary functioning OBD hardware in place, especially given the lead time afforded to OBD in this proposal, the extensive implementation of OBD that has already occurred on heavy-duty vehicles and engines absent any federal regulation, and the experience gained by those industry members affected by this proposal during several years of light-duty and California medium-duty OBD implementation.

Furthermore, EPA does not intend to certify vehicles with federal OBD systems that have more than one OBD system deficiency, and EPA would not allow carryover of any deficiency to the following model year unless it can be demonstrated that correction of the deficiency requires hardware modifications that absolutely cannot be accomplished in the time available, as determined by the Administrator. These limitations are intended to prevent a manufacturer from using the deficiency allowance as a means to avoid compliance or delay implementation of any OBD monitors or to compromise the overall effectiveness of the OBD program. The Agency proposes that the "deficiency allowance" be provided indefinitely, and requests comment on this proposal.

7. Applicability and Waivers

Today's proposed federal OBD requirements would be implemented beginning with the 2004 model year, as described below for all heavy-duty vehicles and engines for which emission standards are in place or are subsequently developed and promulgated by EPA. EPA proposes that there be a phase-in of the OBD requirements for heavy-duty vehicles up to 14,000 pounds GVWR, and for heavy-duty engines up to 14,000 pounds GVWR. The percentage phase-in schedule for such vehicles and engines will be 40/60/80/100 for the 2004/05/06/07 model years, respectively, based on projected sales. The phase-in percentages are determined separately for vehicles and for engines, but are not dependent on fuel.

Specific to Otto-cycle OBD, during model years 2004 through 2006, EPA believes that any non-California Otto-cycle vehicles and engines having essentially equivalent counterparts certified for sale in California as compliant with the LEV emission standards and the CARB OBDII requirements could be readily certified for sale in the remaining 49 states. That belief is based upon engineering judgement that such vehicles and engines will have essentially equivalent emission standards and OBD requirements. The sales mix of LEVs and ultra low emission vehicles (ULEVs) in California is 40 percent and 60 percent, respectively, with 100 percent of those in the less than 14,000 pound GVWR category in compliance with California's OBDII requirements. EPA considers the 40 percent LEV portion as easily certified for 49-state sales. The phased implementation of OBD compliance during the subsequent model years should provide sufficient lead time and flexibility to manufacturers.

In summary, the proposed applicability and phase-ins for heavy-duty OBD compliance are as follows:

COMPLIANCE PHASE-IN FOR TODAY'S PROPOSED OBD PROVISIONS

Model year	Heavy-duty up to 14,000 pounds GVWR	Diesel light duty
2004 MY	—40% compliance —deficiencies available —alternative fuel waivers available —CARB OBDII option available*	—100% compliance. —deficiencies available. —alternative fuel waivers available. —CARB OBDII option available.*
2005 MY	—60% compliance —deficiencies available —alternative fuel waivers available —CARB OBDII option available*	—100% compliance. —deficiencies available. —CARB OBDII option available.*
2006 MY	—80% compliance —deficiencies available —alternative fuel waivers available —CARB OBDII option available*	—same as 2005 MY.
2007+ MY	—100% compliance —deficiencies available —CARB OBDII option available*	—same as 2005 MY.

*But diesels must meet EPA aftertreatment monitoring requirements.

For heavy-duty vehicles and engines up to 14,000 pounds GVWR operating on alternative fuel, EPA would grant OBD waivers during alternative fuel operation through the 2006 model year to the extent that manufacturers can justify the inability to fully comply with any of today's proposed OBD requirements.[86] Such inability would have to be based upon technological infeasibility, not resource reasons. Further, any heavy-duty vehicles and

[86] Note that this provision currently exists for light-duty vehicles and trucks operating on alternative fuel through the 2004 model year; that existing provision does not change with today's proposal.

engines that are subsequently converted for operation on alternative fuel would not be expected to comply with today's proposed OBD requirements if the non-converted vehicle or engine does not comply. In other words, if the vehicle or engine never completes any assembly stage in OBD compliance, it need not comply with today's proposed OBD requirements while operating on the alternative fuel. If the vehicle or engine does complete any assembly stage with a compliant OBD system, it would have to comply with today's OBD requirements while operating on the fuel of original intent and, to the extent feasible, while operating on the alternative fuel. For these latter situations, EPA could grant waivers through the 2006 model year if the manufacturer can show it is infeasible to meet the requirements. Beginning in the 2007 model year, all heavy-duty alternative fueled vehicles and engines up to 14,000 pounds GVWR would have to be fully compliant during both operation on the fuel of original intent and alternative fuel.

EPA requests comments on all aspects of these OBD implementation and phase-in provisions. In particular, EPA requests comments on the phase-in percentages and their application to vehicles and engines separately. The phase-in is proposed in this way because the regulatory structure contains engine based OBD requirements in 40 CFR subpart A and chassis based OBD requirements in 40 CFR subpart S. Therefore, the phase-in percentages would have to be determined independently as they apply to the OBD systems certified according to the provisions of the specific subpart. If this creates unexpected burdens, or eliminates intended flexibilities, comments should explain how and suggest alternate phase-in language.

8. Certification Provisions

The OBD certification information requirements of today's proposal are consistent with the Compliance Assurance Programs 2000 (CAP 2000) rulemaking discussed above. The Part 1 Application must include, for each OBD system: A description of the functional operating characteristics of the diagnostic system; the method of detecting malfunctions for each emission-related powertrain component; and a description of any deficiencies including resolution plans and schedules. Anything certified to the California OBDII regulations would be required to comply with California ARB information requirements. EPA may consider abbreviating the OBD information requirements through rulemaking if it gains confidence that manufacturers are designing OBD systems that are fully compliant with all applicable regulations.

During EPA certification of vehicles optionally certified to the California OBDII regulation, EPA may conduct audit and confirmatory testing consistent with the provisions of the California OBDII requirements. Therefore, while the Agency will consider California certification in determining whether to grant a federal certificate, EPA may also elect to conduct its own evaluation of that OBDII system. While it is unlikely, EPA may make a compliance determination that is not identical to that of the California Air Resources Board.

Further, the Agency fully intends to allow a chassis certified and chassis demonstrated OBD system to fulfill any demonstration requirements of an engine certified OBD system (i.e., ''drop-in'' demonstration). Likewise, we fully intend to allow an engine certified and engine demonstrated OBD system to fulfill the demonstration requirements of a chassis certified OBD system. However, any chassis certified system would have to incorporate transmission diagnostics even though the ''dropped-in'' engine system may not have been certified with them.

In other words, if a manufacturer demonstrates OBD compliance using a chassis certified system, then wishes to employ engineering judgement in demonstrating compliance of an engine certified OBD system, the Agency would accept such a demonstration provided sound engineering judgement is employed. The same would be true for an engine to chassis situation (note the transmission diagnostic stipulation stated above). This allowance is perhaps most applicable to Otto-cycle OBD systems, but it would also apply for diesel systems. The Agency intends to make this allowance because OBD systems tend to be essentially identical in concept and approach across the product line of any given manufacturer, even though specific calibrations may change from engine to engine or model to model. The compliance allowance discussed here requires the manufacturer to rigorously demonstrate its OBD concept and approach on one engine or model, but allows the manufacturer to apply that demonstration via engineering judgement to the different engine and powertrain calibrations used across its fleet.

H. Durability Procedures

Under the current certification regulations, manufacturers develop deterioration factors based on testing of development engines and emissions control systems. Because emissions control efficiency generally decreases with the accumulation of service on the engine, the regulations require that a DF be used in conjunction with engine test results as the basis for determining compliance with the standards. The regulations require that the manufacturer develop an appropriate DF, which is then subject to review by EPA in the certification process. These deterioration factors are applied to low mileage emissions levels of certification engines in order to predict emissions at the end of the engines' useful life. The emissions level after the deterioration factor is applied is the engine certification level, which must be below the standard for the engine to be certified. For engines equipped with aftertreatment (*e.g.,* catalysts), the DF must be ''multiplicative'' (*i.e.,* a factor that can be multiplied by the low mileage emissions level of the certification engine to project emissions at the end of the engine useful life). For engines lacking aftertreatment (*e.g.,* most current diesels), the DF must be ''additive'' (*i.e.,* a factor that can be added to the low mileage emissions level of the certification engine to project emissions at the end of the engine useful life).

Manufacturers have argued that EPA should not propose a standard on the basis of current low engine certification levels, even though these levels are supposed to reflect anticipated emissions levels over the life of the engine. Manufacturers also noted that the deterioration factors capture deterioration for vehicles under typical use and not severe use. Thus, the manufacturers stated that they account for severe deterioration by targeting certification levels at half the standard. EPA has given full consideration to each of these concerns in developing the proposed standards.

EPA believes that the manufacturer's durability process should result in the same or greater level of deterioration than is observed in-use for a significant majority of their vehicles, rather than simply matching the average in-use deterioration. This is especially important considering that incomplete vehicles and vehicles over 14,000 pounds GVWR are more likely to be work vehicles and operated under more severe conditions a greater percentage of their useful lives. In recent certification applications (for the 1998 and 1999 model years, for example), manufacturers have reported NO_X DFs on the order of 1.2 to 1.6 for heavy-duty Otto-cycle engines. Manufacturers have indicated on several occasions that they certify at levels of half the standard to address more severe in-use operation than is represented by their deterioration factors. Based on manufacturer comments, if a durability process is designed to represent the deterioration of a significant majority of engines within an engine family, EPA would expect manufacturers to calculate a multiplicative deterioration factor which is higher than current DFs, on the order of 2.0 or more. Manufacturers also presented EPA with an analysis of engine emissions standards, which is discussed in detail in the Technological Feasibility section below. The catalyst deterioration rates used in that analysis indicate that the deterioration factor could be higher than two in some cases.

EPA believes that it is important for certification levels (emissions tests adjusted by the DF) to represent anticipated in-use emissions levels of a significant majority of in-use engines. This will continue to be a key aspect of EPA's compliance programs. Deterioration factors are also used during production line testing to verify the emissions performance of production engines. Finally, the ABT program relies on certification data as the basis for determining credits. Although Otto-cycle engine manufacturers have not made wide use of the ABT program to date, EPA expects more use of the program in future years due to the new more stringent emissions standards and new ABT flexibilities.

EPA is proposing today that the compliance provisions for heavy-duty engines contained in 40 CFR part 86, subpart A would continue to apply to HDVs subject to the engine-based standards, with modifications designed to ensure that the durability demonstration procedures used by manufacturers in the certification process, and deterioration factors calculated by means of these procedures, predict the emission deterioration of a significant majority of in-use engines to be covered by the procedure.

The deterioration factor determination procedures in the regulations are proposed to be modified to specify that emission control component aging procedures will predict the deterioration of the significant majority of in-use engines over the breadth of their product line which would ultimately be covered by this procedure (manufacturers would be expected to show that their durability programs cover on the order of ninety percent or higher of the distribution of deterioration rates experienced by vehicles in actual use). In addition, manufacturers would be required to calculate multiplicative DFs by dividing high mileage exhaust emissions by the low milage exhaust emissions (*e.g.*, emissions at the useful life mileage by exhaust emissions at 4,000 miles).[87] This change only adds specificity to the regulations so that DFs are calculated using a consistent and credible methodology. These proposed modifications to the engine-based HDV compliance procedures would be effective for any engine family generating ABT credits prior to the 2004 model year. EPA requests comment on the proposed modifications to the engine-based compliance program durability procedures.

I. Non-Conformance Penalties

Non-conformance penalties are monetary penalties that manufacturers can pay instead of complying with an emission standard. (*See* CAA section 206(g) and 40 CFR part 86, subpart L.) In the final rule for the 2004 standards for diesel heavy-duty engines, we stated that provisions related to NCPs would be addressed in the 1999 Review. (*See* 62 FR 54700; October 21, 1997.) In order to establish NCPs for a specific standard, EPA must find that: (1) Substantial work will be required to meet the standard for which the NCP is offered; and (2) there is likely to be a ''technological laggard'' (i.e., a manufacturer that cannot meet the standard because of technological (not economic) difficulties and, without NCPs, might be forced from the marketplace). We also must determine compliance costs so that appropriate penalties can be established.

For diesel heavy-duty engines, the most recent NCPs established were for the 1994 particulate standard (0.10 g/bhp-hr) and the 1998 NO_X standard (4.0 g/bhp-hr). NCPs have not been established to date for Otto-cycle heavy-duty engines. NCPs were used extensively by manufacturers of highway heavy-duty engines in the late 1980s, prior to the implementation of our averaging, banking and trading program. Since that time, however, their use has been rare. We believe manufacturers have taken advantage of the averaging, banking and trading program as a preferred alternative to incurring monetary losses.

[87] Manufacturers are not required to accumulate actual mileage on vehicles or engines in order to determine a deterioration rate. In many cases, the accumulation of mileage (or ''service'') is simulated by various ''bench aging'' techniques that allow the process to consume less time and resources than accumulating actual mileage.

At this time, EPA has insufficient information indicating that both of the criteria described above are met for diesel or Otto-cycle heavy-duty engines. While we believe that substantial work will be required to meet the 2004 standards, we have no information indicating that a technological laggard is likely to exist. We also believe that the existing NO_X and particulate averaging, banking and trading program already provides considerable flexibility to meet the emission standards. Therefore, we are not proposing NCPs as part of today's proposed program, but we request comment on whether NCPs are necessary for the 2004 standards for diesel or Otto-cycle heavy-duty engines. Particularly, commenters should address the two criteria described above for establishing NCPs (''substantial work'' and ''technological laggard''). We recognize that it may be premature for manufacturers to comment on these criteria, since implementation of the 2004 standards is still five years away. It may be more prudent to consider addressing NCPs in a future action as we approach implementation of the 2004 standards.

V. Additional Heavy-Duty Engine Provisions Under Consideration

In addition to the provisions proposed in this notice, EPA is currently reviewing several related regulatory issues concerning control of emissions from heavy-duty vehicles and engines. As discussed in section X below, EPA is reviewing the feasibility of more stringent standards for heavy-duty vehicles and engines in the future, and the impact of fuel quality on that question. In addition, EPA believes that there are several provisions related to the need for an effective emissions control program that will benefit from further evaluation and development prior to proposal. EPA intends to explore these provisions further in the coming months and publish a notice of proposed rulemaking dealing with these issues in a separate regulatory process within the next 12 months. We would expect to follow this with a final rule in early 2001.

In particular, there are four issues—a revised definition of rated speed, OBD requirements for engines used in vehicles above 14,000 GVWR, a manufacturer-based in-use test program, and application of the NTE approach to heavy-duty Otto-cycle engines—that we intend to deal with in the separate process. As explained below, EPA believes that there are several open issues and/or informational gaps that need to be reviewed regarding these issues prior to proposal of regulations.

As EPA wishes to complete the current rulemaking process as quickly as possible, EPA believes that it is appropriate to proceed with the current rulemaking without addressing these four issues at this time. This will allow us to gather information and work with interested parties in a separate process regarding these issues.

In a letter to EPA dated July 1, 1999, the Engine Manufacturers Association (EMA) committed to ''work diligently and cooperatively'' with EPA and CARB to resolve the open questions in a timely fashion.[88] EMA's letter outlined a process that does not preclude implementation of these programs in the 2004 model year, and in fact, highlights model year 2004 implementation as a stated goal of this cooperative effort. A cooperative approach to data-collecting, analysis, and problem-solving can help in developing the proposals for these issues. EPA will work with all parties involved, including states and environmental organizations, to develop robust, creative, environmentally protective and cost-effective proposals addressing these issues.

A. Revision to the Definition of Rated Speed

The definition of rated speed, where speed is the angular velocity of an engine's crankshaft (usually expressed in revolutions per minute, or rpm) is an important aspect of the existing FTP for on-highway HD diesel engines. The rated speed definition is important to the FTP because it is used to define the range of engine speeds over which the engine will be exercised during the test. The regulations require engine manufacturers to declare rated speeds consistent with the regulation for their engines for the purpose of testing on the FTP cycle; however, past experience has raised our concern that selection of rated speed for the purpose of FTP testing is not being performed consistently across the entire HD industry. We are concerned that some manufacturers have declared rated speeds which result in the FTP test being run over a speed and torque range which are not representative of the operating characteristics of a particular engine family, in order to influence the parameters under which the engine family is certified. Under the existing transient HD FTP, manufacturers could receive a NO_X emission benefit if they declared a rated speed that was higher than that envisioned under the regulations.

The on-highway HD diesel regulation defines rated speed as the speed at which the manufacturer specifies the maximum rated horsepower from the engine. The torque and rpm points used on the FTP are determined in part from the measured rated rpm, which in turn is determined using the rated speed or the calculated speed, whichever yields the higher speed (*see* 40 CFR 1330–90(g)). The calculated rated speed is determined by averaging the minimum and maximum speeds at which 98 percent of maximum power is generated. This definition was sufficient when it was developed in the late 1970's for engines with mechanical fuel injection and mechanical speed governors. For these engines, the slope of the power vs. speed lug curve remained monotonic and positive as speed increased until the mechanical governor engaged. At this point of governor control, the slope of the curve rapidly became sharply negative as speed increased toward the maximum governed speed. Therefore, maximum power occurred at nearly only one speed, and this speed was clearly identifiable by the breakpoint in the lug curve where the governor caused a rapid change in slope from positive to sharply negative. Engine manufacturers typically reported this speed as rated speed for sales and service literature as well as for FTP testing. Furthermore, the calculated rated speed calculation returned nearly the same speed, because of the nature of these lug curves with respect to the calculation.

With the advent of electronically fuel injected and governed engines, manufacturers began to design engines with high torque rises to meet customer demands. High torque rise engines often have lug curves in which the maximum power-speed point occurs at a much lower speed than mechanical engines. This power point is often at the maximum, where to the left and right of the maxima, the slope is slightly positive and negative, respectively. As speed increases beyond this maximum, the power does not taper off sharply, as in the case of mechanical engines. The electronic engines, on the other hand, have gradually negative slopes, and sometimes they even have a slight inflection to zero slope before the electronic speed governor engages. These characteristics render the rated speed calculation less meaningful because the two 98 percent speed points are often at very different speeds along the gradual positive and negative slopes around the actual maximum power-speed. Because of these characteristics of electronic engines, EPA believes there now exists a need for an objective and singular definition of rated speed for the purposes of FTP testing.

We believe a new definition of rated speed is warranted, and that a new definition should be both objective and representative of in-use operation. The rated speed definition should be objective and should result in a single value for a given engine family. This would avoid inequitable testing. The rated speed definition should also result in an FTP test cycle which exercises the engine's emission control system over a range of engine speeds and loads that are representative of in-use operation.

The Agency is not proposing a new definition of HD rated speed in today's action. While the Agency believes there are issues associated with the current definition with rated speed, there are a number of issues with developing a new definition which have not yet been resolved. We intend to include a proposal for a new definition in a forthcoming proposal, and we intend to work with the industry, the California Air Resources Board, and other interested parties in the upcoming months to develop such a proposal. The Agency recently proposed a definition of rated speed for nonroad diesel marine engines which may be an appropriate blueprint for the on-highway industry (*see* 63 FR 68528, October 21, 1998). The reader is encouraged to examine the proposed nonroad diesel marine definition as one possible approach for the on-highway HD diesel industry.

B. A Manufacturer-Based In-Use Testing Program for Heavy-Duty Engines

To help ensure that heavy-duty engines meet applicable emission standards throughout their useful lives, the Agency must have reasonable certainty that the emissions measured in the laboratory during certification of prototype engines reflect those experienced during real world operation of actual in-use engines. We believe that a manufacturer-run in-use testing program is an important way to ensure that the 2004 emission standards for heavy-duty engines are achieved in actual use throughout their useful lives, as required by the Act. We believe that manufacturers are best suited to run such an in-use testing program for several reasons. First, we understand that manufacturers commonly evaluate in-use engines on the road to support their engine development process and troubleshoot customer concerns. For manufacturers already conducting such in-use engine performance testing, we see an in-use testing program as adding an emissions measurement component.

[88] Letter from Mr. Jed R. Mandel, Neal Gerber & Eisenberg, to Margo Oge, Office of Mobile Sources, July 1, 1999. Available in the public docket for review.

Second, we also understand that, through these product development and customer service/product warranty activities, manufacturers maintain a close relationship with the purchasers of their engines. We believe that this close customer relationship makes engine manufacturers best suited to locate and obtain in-use vehicles for emissions testing. For anyone other than the manufacturer, it would be difficult to locate in-use vehicles powered by a particular engine family, because heavy-duty trucks travel throughout the country. Since these trucks often are integral to business operations, owners may be unwilling to part with them for testing by entities other than the manufacturer. However, we expect that some owners, especially those of larger fleets, will view participation of their vehicles in an in-use testing program as an opportunity to establish an even stronger relationship with the manufacturer. This arrangement with the manufacturer could lead to other benefits to the owner, such as an opportunity to better communicate product needs.

Such a program would require manufacturers to measure emissions from a sample of in-use vehicles. Several issues need to be reviewed prior to proposal. These include the test procedures used for the in-use testing, the number of vehicles or engines that would be required for testing, and whether such testing will be done on engines (or vehicles) run in a laboratory or vehicles tested on the road. In the past, the laboratory testing of HD engines has been difficult for a number of reasons, with cost being one of the most significant barriers. In recent years, important advancements have been made in a number of emission measurement technologies as well as on-board engine management technologies which could allow for the development of a new and innovative in-use testing program for HD engines.

Today's action does not contain a proposal for manufacturer in-use testing of HD engines, with the exception of those HD Otto-cycle chassis certified engines which would be covered by the CAP 2000 provisions of today's proposal (*see* section IV.E.5—Compliance Assurance Program). The Agency does not believe that it currently has enough information to determine the most appropriate parameters of a manufacturer-run in-use testing program. However, the Agency intends to work with the engine manufacturers, CARB, the emissions measurement industry, and other interested parties over the next several months to explore these issues in order to achieve the goal of a meaningful in-use testing program which would be run by the engine manufacturers.

C. On-Board Diagnostics for Heavy-Duty Engines and Vehicles Above 14,000 Pounds GVWR

Similar to the expected benefits of having OBD requirements on light-duty vehicles and trucks, and heavy-duty vehicles and engines up to 14,000 pounds GVWR, we believe that there are similar benefits to having OBD requirements for applications over 14,000 pounds GVWR. However, there are many potential issues associated with applying OBD requirements to applications above 14,000 pounds GVWR 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 difficult 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 dealt with effectively, 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 classes above 14,000 pounds GVWR. 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 proposing OBD requirements for engines above 14,000 pounds GVWR 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.

D. Applying the Not-To-Exceed Approach and Emission Limits to Heavy-Duty Otto-Cycle Engines

Though today's action contains supplemental standards for HD diesel engines (Not-to-Exceed test and associated standards, Supplemental Steady State Test and associated standards, and the Load Response Test) today's action does not include similar provisions for HD Otto-cycle engines. As noted earlier, EPA's primary interest is developing an effective means of controlling actual in-use emissions across a broad range of in-use operation, a concern that extends to Otto-cycle engines as much as it does diesel engines. We believe that the same concerns which necessitate supplemental standards and test procedures for HD diesel engines may also exist for HD Otto-cycle engines, and that measures similar to those proposed for diesels to assure effective in-use control may also be warranted for Otto-cycle engines. We believe that the NTE approach is a valuable concept for accomplishing this goal for heavy-duty Otto-cycle engines, just as it is for diesels. However, we have not had as much time to consider such an approach for Otto-cycle engines, and data collection enabling appropriate setting of an NTE emission limit and definition of an Otto-cycle NTE zone is still underway as of today's proposal. Like other issues described in this section, we intend to work with the engine manufacturers, CARB, and other interested parties over the next several months to develop an NTE or similar approach to achieve the goal of assuring effective in-use control of HD Otto-cycle engines over a broad range of in-use operation.

VI. Are the Proposed Requirements Technologically Feasible?

A. 2004 Emission Standards for Heavy-Duty Diesel Engines

Today's proposal contains a reaffirmation of the 2004 NMHC+NO_X standards as well as several supplemental standards and test cycles for 2004 model year HDDE;

—2.4 g/bhp-hr NMHC + NO_X or 2.5 g/bhp NMHC + NO_X with a limit of 0.5 g/bhp-hr on NMHC on the existing Federal Test Procedure

—Emission standards of 1.0 times the FTP standards on the new Supplemental Steady-state Test Cycle

—Emission standards of 1.25 times the FTP standards under the new Not-to-Exceed test zone

Based on the information currently available to EPA, we believe manufacturers are making significant progress towards meeting the 2004 standards contained in today's proposal, and we believe the standards are technologically feasible. Chapter 3 of the draft RIA for this proposal contains a detailed description of the technologies we expect engine manufacturers to utilize to meet the proposed 2004 standards. The discussion here is a summary of the draft RIA discussion; the reader should refer to the RIA for a more detailed discussion. We request comment on this discussion and on our proposed feasibility assessment.

HD diesel engines being certified to the 1998 U.S. standards are already utilizing several advanced technologies, including high-pressure fuel injection systems, redesigned combustion chambers, air-to-air aftercoolers, waste-gated turbochargers and electronic controls. These technologies have allowed engine manufacturers to meet the emission standards which went into effect in 1998, while continuing to provide end users with improved fuel economy, improved durability, and improved driveability. The Agency expects to see incremental improvements in some of these strategies between now and 2004, but these improvements alone will not lower NMHC+NO_X emissions to the levels needed to meet the 2004 standards, and also comply with the current PM standard. To meet the 2004 standards, EPA expects that, in addition to the aforementioned strategies, manufacturers will utilize EGR, variable geometry turbo-chargers, fuel injection rate shaping, and possibly exhaust aftertreatment.

1. Probable Emission Control Strategies

Exhaust Gas Recirculation. EGR is the recirculation of exhaust gas from a point in an engine's exhaust system to a point in the intake system. EGR is used to decrease nitric oxide (NO) emissions, the primary species in diesel oxides of nitrogen. EGR dilutes intake air with combustion products, namely carbon dioxide (CO_2) and water vapor. These diluents decrease the adiabatic stoichiometric flame temperature for a given mass of fuel and oxygen burned.[89] This decrease in temperature exponentially decreases the oxidation rate of dissociated nitrogen (N) to NO.[90] EGR also decreases the mole fraction of oxygen, which proportionally decreases the oxidation rate of N to NO.[91]

EGR is very effective at decreasing NO_X. Laboratory studies have shown that EGR can reduce NO_X emissions by up to 90 percent at light load and up to 60 percent at full load near rated speed.[92] Additional studies have shown similar reductions at other speeds and loads.[93] However, because EGR decreases the overall rate of combustion in the cylinder, EGR tends to increase PM emissions and brake specific fuel consumption (BSFC). Furthermore, if EGR is not cooled before it is introduced to the intake system, it will reduce the density of the intake charge, and thus decrease the volumetric efficiency of the engine, which will decrease maximum power and increase BSFC. Hot EGR also offsets EGR's beneficial effect on combustion temperature because hot EGR increases the initial temperature of the air charge. Finally, EGR without additional boost air can result in incomplete combustion and an increase in PM emissions. Through proper EGR system design, however, researchers have demonstrated that these undesirable effects of EGR can be minimized so that the 2004 emission standards can be met, including fully offsetting the potential increase in PM to enable engines to continue to comply with the 0.1 g/bhp-hr standard.[94] The draft RIA contains additional discussion of how these issues are being addressed.

From a design perspective, EGR poses several challenges for it to be technologically feasible. First, a sufficient positive pressure difference must exist between the point in the exhaust system where the exhaust gas is extracted and the point in the intake system where it is introduced. Second, under most conditions, EGR should be cooled for best performance. Third, the rate of EGR must be controlled accurately, and the control system must respond quickly to changes in engine operation.[95] As discussed in more detail in the draft RIA, the Agency believes engine and component manufacturers have either resolved these design challenges, or have made significant progress towards a resolution. EPA believes the remaining challenges can be resolved considering the lead time remaining to engine manufacturers, and the use of ABT to introduce the technology across the product line over a period of time.

Fuel Injection Rate-shaping. Another key emission control strategy that EPA expects heavy-duty diesel engine manufacturers to use to meet the 2004 emission standards is fuel injection rate shaping. Injection rate shaping has been shown to simultaneously reduce NO_X by 20 percent and PM by 50 percent under some conditions.[96] It has also been shown to reduce BSFC by up to 10 percent without increasing NO_X emissions.[97] However, it can also lead to increases in smoke emissions and may not be as effective on low-NO_X engines equipped with EGR. Fuel injection rate shaping refers to precisely controlling the rate of fuel injected into the cylinder on a crank-angle by crank-angle resolution. Specific rate-shaping methods include pilot injection where a pilot quantity of fuel, typically less than two percent of the total fuel charge, is injected at some crank angle before the main injection event.[98] Split fuel injection refers to splitting, more or less evenly, the main injection into two or more separate injections (split injection is also referred to as pilot injection). Other methods include ramping the main injection event so that it resembles a triangular profile, rather than a conventional, square-shaped profile. Effective injection rate-shaping systems modulate the fuel injection timing, pressure, rate, and duration independent of engine speed and load. This characteristic of the fuel system

[89] Heywood J.B.: Internal Combustion Engine Fundamentals, McGraw-Hill, Inc, New York, p. 590, 1988.

[90] Dodge L.G., D.M. Leone, D.W. Naegeli, D.W. Dickey, K.R. Swenson: ''A PC-Based Model for Predicting NO_X Reductions in Diesel Engines,'' SAE paper 962060, p.149, 1996.

[91] *Ibid.*

[92] Dickey D.W., T.W. Ryan III, A.C. Matheaus: ''NO_X Control in Heavy-Duty Engines—What is the Limit?'', SAE paper 980174, 1998. Dickey; and, Zelenka P., H. Aufinger, W. Reczek, W. Cartellieri: ''Cooled EGR—A Key Technology for Future Efficient HD Diesels,'' SAE paper 980190, 1998.

[93] Kohketsu S., K. Mori, K. Sakai, T. Hakozaki: ''EGR Technologies for a Turbocharged and Intercooled Heavy-Duty Diesel Engine,'' SAE paper 970340, 1997; Baert R., D.E. Beckman, A.W.M.J. Veen: ''EGR Technology for Lowest Emissions,'' SAE paper 964112, 1996; and, Heavy-duty Engine Working Group, Mobile Source Technical Advisory Subcommittee of the Clean Air Act Advisory Committee, ''Phase 2 of the EPA HDEWG Program—Summary Document'', available in EPA Air Docket A–98–32.

[94] Dickey D.W., T.W. Ryan III, A.C. Matheaus: ''NO_X Control in Heavy-Duty Engines-What is the Limit?'', SAE paper 980174, 1998.

[95] Zelenka P., H. Aufinger, W. Reczek, W. Cartellieri: ''Cooled EGR—A Key Technology for Future Efficient HD Diesels,'' SAE paper 980190, 1998.

[96] Dickey D.W., T.W. Ryan III, A.C. Matheaus: ''NO_X Control in Heavy-Duty Engines—What is the Limit?'', SAE paper 980174, 1998.

[97] Boehner W., K. Hummel: ''Common Rail Injection System for Commercial Diesel Vehicles'', SAE paper 970345, 1997; and Uchida N, K. Shimokawa, Y. Kudo, M. Shimoda: ''Combustion Optimization by Means of Common Rail Injection System for Heavy-Duty Diesel Engines'', SAE paper 982679, 1998.

[98] Boehner W., K. Hummel, ''Common Rail Injection System for Commercial Diesel Vehicles'', SAE 970345, 1997.

implies that it should be mechanically de-coupled from the engine. Timing is then achieved, presumably, by electronic control.

Rate shaping is used to control the rate of combustion within the cylinder. By controlling combustion rate, the rate of pressure and temperature rise is controlled. Therefore, rate shaping controls NO_X formation by one of the same mechanisms as EGR; it is used to lower peak combustion temperatures. Rate shaping can affect the time and temperature at which combustion ends, therefore it can also lower PM emissions by enhancing the mechanisms of in-cylinder soot oxidation.[99]

Several manufacturers and fuel system suppliers have demonstrated fuel injection systems that can achieve effective rate shaping. The three most common systems are the common rail; the mechanically actuated electronically controlled unit injector (MEUI); and the hydraulically actuated, electronically controlled unit injector (HEUI). These systems are described in more detail in the draft RIA (see Chapter 3).

Several studies have suggested rate-shaping methods to achieve emissions benefits. Researchers have reported decreased NO_X and PM emissions at intermediate speeds and loads by optimizing reduced-rate pilot injection with a high-pressure main injection, and one report suggested a strategy at high loads.[100 101 102] At intermediate loads, burnt pilot fuel is used as a torch to decrease ignition delay of the main injection event. This lowers peak flame temperatures and, thus, NO_X formation. At high loads the ignition delay is not as significant, but a very early pilot event (>20° before top-dead center) can be used to distribute low-temperature burnt gas in the cylinder, similar to EGR. This method can be optimized to decrease NO_X, PM, and BSFC simultaneously. Other reports have suggested ramped main injection at high loads and high speeds to decrease NO_X, square main injection at peak torque to decrease PM, and split injection at idle to decrease volatile PM (*i.e.* white smoke).

EPA expects manufacturers to utilize fuel injection rate shaping to meet 2004 emission standards. EPA believes the strategy is technologically feasible because fuel injection rate shaping is used to a limited extent today to meet 1998 emissions standards, and several manufacturers have announced the introduction in the next few years of next-generation fuel injection systems with rate shaping ability. Furthermore, EPA expects even greater emission control through rate shaping as manufacturers continue to develop advanced fuel systems and control algorithms. We request comment on the feasibility of rate shaping and EGR in the 2004 time frame.

2. Feasibility of 2004 HD Diesel Standards

EPA expects manufacturers to utilize a combination of technologies in order to meet the proposed 2004 standards, such as cooled EGR systems with VNT and advanced fuel injection with rate shaping capability. The draft RIA for this rule, as well as the final RIA for the 1997 rule, contains a summary of the emission performance of a number of technology combinations which have been published in the referred literature in the past several years. These published results are on a variety of laboratory test cycles, including the U.S. transient heavy-duty FTP, the old European ECE–R49 13 mode steady-state cycle, and the new European Euro III steady-state cycle (which the U.S. EPA new supplemental steady-state cycle in this proposal is based on).

The published results referenced in the draft RIA show a waste-gated turbocharged engine with a high-pressure loop EGR system and a MEUI fuel system achieving NO_X levels on the new Euro III cycle at levels between 1.83 and 3.24 g/bhp-hr (the 1.83 level resulted in a 2.4 percent increase in fuel consumption), with corresponding PM levels between 0.15 and 0.06 g/bhp-hr. Results on a HD diesel engine equipped with a VNT, high-pressure loop EGR system, and high pressure fuel injection system achieved results on the older European ECE–R49 cycle for NO_X between 1.80 and 2.24 g/bhp-hr (the 1.80 level resulted in a 2.3 percent increase in fuel consumption). For both tests a PM level of 0.08g/bhp-hr was reported. Results referenced in the final RIA for the 1997 rule include a study which resulted in HC+NO_X levels of 2.54 g/bhp-hr on the U.S. HD transient FTP, this engine was equipped with an EGR system, a rate-shaping fuel injection system, and an oxidation catalyst and was run on a low sulfur fuel.

The Agency believes the technologies described above and in the draft RIA will provide the emission reductions necessary to allow engine manufacturers to meet the proposed 2004 standards. These control technologies have been demonstrated to provide significant emission reductions under both transient and steady-state test conditions. Steady-state and transient operation are represented in this proposal by the existing FTP, and the new NTE, LRT, and supplemental steady-state cycle.

In order to meet the proposed NTE standards, manufacturers will need to perform emission mapping of each engine family in order to insure that over the NTE control zone, optimization of the emission control system provides sufficient control of the emission map for each pollutants which will maintain levels below the 1.25 times the FTP standard over a 30 second interval. EPA believes the emission control technologies discussed previously as well as in the RIA are capable of providing this level of emission control. The emission control capacities of these technologies are applicable to NTE and LRT test conditions in the same manner as they apply to the transient and steady-state test conditions. The less stringent levels for NTE should also provide a level of assurance to manufacturers.

As discussed, several publicly available studies have shown results which approach or surpass the proposed standards, though several indicate fuel economy penalties on the order of two percent. Significant development and demonstration of cooled EGR, VNT, and fuel injection systems has been performed in the past two years. Engine manufacturers have four years of lead time available in which to continue to fully develop and optimize these control technologies in order to meet the proposed standards, as well as to minimize or eliminate the fuel economy penalty associated with some technologies. Finally, the 1997 rulemaking put in place ABT provisions for HD diesel engines for the 2004 standards. These ABT provisions provide engine manufacturers with considerable flexibility in determining how they will meet the proposed standards on a corporate average, and thus provides the manufacturers with some level of flexibility in determining how to apply the range of technologies available across their product line.

Technology combinations of cooled EGR systems, VNTs, and advanced fuel injection systems have been

[99] Heywood, J.B., Internal Combustion Engine Fundamentals, McGraw-Hill, Inc., New York, p. 643–644, 1988.

[100] Ikegami, M., K. Nakatani, S. Tanaka, K. Yamane: ''Fuel Injection Rate Shaping and Its Effect on Exhaust Emissions in a Direct-Injection Diesel Engine Using a Spool Acceleration Type Injection System'', SAE paper 970347, 1997.

[101] Uchida N, K. Shimokawa, Y. Kudo, M. Shimoda: ''Combustion Optimization by Means of Common Rail Injection System for Heavy-Duty Diesel Engines'', SAE paper 982679, 1998.

[102] Dickey D.W., T.W. Ryan III, A.C. Matheaus: ''NO_X Control in Heavy-Duty Engines—What is the Limit?'', SAE paper 980174, 1998.

demonstrated in the past several years which are capable of meeting the proposed 2004 standards. Engine manufacturers have an additional four years of lead time to develop and optimize these control systems. EPA has considered the well known inverse relationship between NO_X and PM. As discussed previously, integrated emission control technology packages (cooled EGR, VNT, and advanced fuel injection system) have been demonstrated to significantly reduce NO_X with a minimal increase in PM. Considering the several years of additional lead time available to manufacturers, achievement of the 2004 standards is clearly feasible. In addition, as discussed in the draft RIA, other control methods, such as aftertreatment, though unnecessary to meet the 2004 standards, could be used to further reduce emissions. The ABT provisions provide engine manufacturers some flexibility in determining the appropriate mix of technologies across their product line. For these reasons, EPA fully anticipates that engine manufacturers will meet the 2004 standards contained in today's proposal.

B. 2004 Emission Standards for Heavy-Duty Otto-Cycle Vehicles and Engines

This section discusses the current technologies being used by manufacturers and the key technology changes we believe would be available to meet the proposed 2004 vehicle and engine standards. Technological feasibility of the exhaust emissions standards is presented first, followed by analyses for ORVR controls. Manufacturers would ultimately decide what is best for their individual product lines. Further information on the various available technologies and EPA's technological feasibility assessment is contained in the Technological Feasibility section of the Regulatory Impact Analysis. We request comment on the following discussion and on our feasibility assessment for heavy-duty Otto-cycle vehicles and engines.

1. Current Technologies

Gasoline engine manufacturers are already producing heavy-duty engines that achieve a level of emission control better than the control required by current standards. Table 12 provides a list of some key technologies currently being used for HD engine emissions control. Manufacturers have introduced improved systems as they have introduced new or revised engine models. These systems can provide very good emissions control and many engines are being certified to levels of less than half the current standards. Many of the technologies have been carried over from light-duty applications.

Table 12.—Key Technologies for Current Heavy-Duty Otto-Cycle Engines

Sequential Fuel Injection/electronic control
- 3 way catalyst
- Pre and post catalyst heated oxygen sensors

Electronic EGR
Secondary air injection
Improved electronic control modules

Improving fuel injection has been proven to be an effective and durable strategy for controlling emissions and reducing fuel consumption from gasoline engines. Improved fuel injection will result in better fuel atomization and a more homogeneous charge with less cylinder-to-cylinder and cycle-to-cycle variation of the air-fuel ratio. These engine performance benefits will increase as technology advances allow fuel to be injected with better atomization. Increased atomization of fuel promotes more rapid evaporation by increasing the surface area to mass ratio of the injected fuel. This results in a more homogeneous charge to the combustion chamber and more complete combustion. Currently, sequential multi-port fuel injection (SFI) is used in most, if not all, applications under the proposed standards because of its proven effectiveness.

One of the most effective means of reducing engine-out NO_X emissions is EGR. By recirculating spent exhaust gases into the combustion chamber, the overall air-fuel mixture is diluted, lowering peak combustion temperatures and reducing NO_X. Exhaust gas recirculation is currently used on heavy-duty Otto-cycle engines as a NO_X control strategy. Many manufacturers now use electronic EGR in place of mechanical back-pressure designs. By using electronic solenoids to open and close the EGR valve, the flow of EGR can be more precisely controlled.

EPA believes that the most promising overall emission control strategy for heavy-duty Otto-cycle engines is the combination of a three-way catalyst and closed loop electronic control of the air-fuel ratio. Control of the air-fuel ratio is important because the three-way catalyst is effective only if the air-fuel ratio is at a narrow band near stoichiometry. For example, for an 80 percent conversion efficiency of HC, CO, and NO_X with a typical three-way catalyst, the air-fuel ratio must be maintained within a fraction of one percent of stoichiometry. During transient operation, this minimal variation cannot be maintained with open-loop control. For closed-loop control, the air-fuel ratio in the exhaust is measured by an oxygen sensor and used in a feedback loop. The throttle position, fuel injection, and spark timing can then be adjusted for given operating conditions to result in the proper air-fuel ratio in the exhaust. Most if not all engines have already been equipped with closed loop controls. Some engines have been equipped with catalysts that achieve efficiencies in excess of 90 percent. This is one key reason engine and vehicle certification levels are very low. In addition, electronic control can be used to adjust the air-fuel ratio and spark timing to adapt to lower engine temperatures, therefore controlling HC emissions during cold start operation.

All HD Otto-cycle engines are already equipped with three-way catalysts. Engines may be equipped with a variety of different catalyst sizes and configurations. Manufacturers choose catalysts to fit their needs for particular vehicles. Typically, catalyst systems are a single converter or two converters in series or in parallel. A converter is constructed of a substrate, washcoat, and catalytic material. The substrate may be metallic or ceramic with a flow-through design similar to a honeycomb. A high surface area coating, or washcoat, is used to provide a suitable surface for the catalytic material. Under high temperatures, the catalytic material will increase the rate of chemical reaction of the exhaust gas constituents.

Significant changes in catalyst formulation have been made in recent years and additional advances in these areas are still possible. Platinum, Palladium and Rhodium (Pt, Pd, and Rh) are the precious metals typically used in catalysts. Historically, platinum has been widely used. Today, palladium is being used much more widely due to its ability to withstand very high exhaust temperatures. In fact, some HD vehicles currently are equipped with palladium-only catalysts. Other catalysts contain all three metals or contain both palladium and rhodium. Some manufacturers have suggested that they will use Pd/Rh in lieu of tri-metal or conventional Pt/Rh catalysts for underfloor applications. Improvements in substrate and washcoat materials and technology have also significantly improved catalyst performance.

2. Chassis-Based Standards

EPA is proposing to extend the California LEV–I MDV standards nationwide. California began requiring some vehicles to meet LEV standards in 1998 and the phase-in will be complete in 2001. The technological feasibility assessment and technology projections are based primarily on the mix of technologies being used to achieve California LEV emissions levels.

Of the anticipated changes, enhancements to the catalyst systems are expected to be most critical. Catalyst configurations are likely to continue to vary widely among the manufacturers because manufacturers must design the catalyst configurations to fit the vehicles. One potential change is that manufacturers may move the catalyst closer to the engine (close-coupled) or may place a small catalyst close to the engine followed by a larger underfloor catalyst. These designs provide lower cold start emissions because the catalyst is closer to the engine and warms up more quickly. Typically, the catalyst systems used in HD applications have a large total volume but with lower precious metal content per liter compared to light-duty catalyst systems. For 2004, EPA projects an increase in overall precious metal loading of about 50 percent. EPA does not expect significant increases in total catalyst volume.

Calibration changes will also be important. The engine and catalyst systems must be calibrated to optimize the performance of the systems as a whole. Post catalyst oxygen sensors will allow further air fuel control. Manufacturers are moving to more powerful computer systems and EPA expects this trend to continue. Other technologies such as insulated exhaust systems may also be used in some cases to reduce cold start emissions.

HD vehicles in California have typically been certified with full life emissions levels in the 0.3–0.5 g/mile range for NO_X and the 0.1–0.3 g/mile range for NMOG. These levels are well within the LEV standards and provide manufacturers with a compliance cushion. EPA expects manufacturers to sell these vehicles or very similar vehicles nationwide to meet the proposed EPA standards.

3. Engine-Based Standards

Currently, most engine families are certified with emissions levels of less than half the standard. Only one engine family is certified with NO_X emissions levels within 10 percent of the current 4.0 g/bhp-hr NO_X standards. Manufacturers have begun to apply advanced system designs to their heavy-duty applications. Recently introduced engine families have been certified with emissions levels of 0.5 g/bhp-hr combined NMHC+NO_X.[103] These engines and systems feature precise air/fuel control and superior catalyst designs comparable to the catalyst systems being used in the California LEV program. Based on industry input, we believe that manufacturers will continue the process of replacing their old engine families with advanced engines over the next several years. As new and more advanced engines are introduced, EPA anticipates that they will be capable of achieving the proposed standards.

Manufacturers have stated on several occasions that they target emissions certification levels of about half the standard, due to the potential for in-use deterioration of catalysts and oxygen sensors. 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 currently conducted for engine certification. Manufacturers have argued that EPA should not set new standards based on certification data because certification levels do not account for severe in-use deterioration. Based upon these comments EPA would expect that manufacturers would certify engines at about 0.5 g/bhp-hr NMHC+NO_X in order to ensure compliance with the 1.0 g/bhp-hr standard.

Catalyst systems with increased precious metal loading will be a critical hardware change for meeting the proposed engine standards. Optimizing and calibrating the catalyst and engine systems as a whole will also be important in achieving the proposed standards. Increased use of air injection to control cold start emissions may also be needed, especially to reduce NMHC emissions during cold start operation. Also, improved EGR systems and retarded spark timing may be needed to reduce engine out NO_X emissions levels.

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. Manufacturers have often taken steps to protect catalysts by ensuring exhaust temperatures remain in an acceptable range. 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 catalysts have been shown to withstand temperatures typically experienced in HD applications. Manufacturers also continue to limit exhaust temperature extremes not only to protect catalyst systems but also to protect the engine.

In addition to general comments noted above regarding the need for compliance cushion, manufacturers presented EPA with an analysis of the Otto-cycle engine emissions standards for 2004.[104] The analysis assumed:

- Worst-case NO_X catalyst efficiency of 90.9 percent at the end of the engine's useful life
- Worst-case engine-out NO_X level of 12 g/bhp-hr
- A cushion of .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 NO_X level (.26 g/bhp-hr)

Based on these assumptions, manufacturers recommended a 2.0 g/bhp-hr NMHC plus NO_X standard, according to the following methodology.

Variability=0.3 g/bhp-hr (eq. 1)

Safety Margin=20% (NO_X level) (eq. 2)

NMHC Level=14.8 % (NO_X Level) (eq. 3)

Combined NMHC+NO_X Standard=NO_X Level+NMHC Level (eq. 4)

NO_X Level=Post-catalyst NO_X rate+Variability+Safety Margin (eq. 5)

(Step 1) Post-catalyst NO_X rate=(1 − conversion efficiency)×Engine-Out NO_X level=(1–0.91)×12 g/bhp-hr=1.09 g/bhp-hr (eq. 6)

(Step 2) Putting eq. (1), (2), and (6) into equation (5)—NO_X Level=1.09 g/bhp-hr+0.3 g/bhp-hr+0.2×NO_X Level (eq. 5b)

(Step 3) Solving Equation (5b) for NO_X Level gives—NO_X Level=(1.09 g/bhp-hr+0.3 g/bhp-hr)/(1–0.2)=1.74 g/bhp-hr

(Step 4) Placing the results from (Step 3) into Equation 5 gives—NMHC Level=14.8% NO_X Level=0.148×1.74 g/bhp-hr=0.26 g/bhp-hr

(Step 5) Placing the results from (Step 3) and (Step 4) into equation (1) gives: Combined NMHC+NO_X Standard=0.26 g/bhp-hr+1.74 g/bhp-hr=*2 g/bhp-hr*

Manufacturers noted that a catalyst efficiency of about 97 percent would be

[103] EPA is not proposing to set the standard at this level because EPA recognizes that a manufacturer needs to design their technology to build in sufficient compliance margin, based on the technology and standards at issue here.

[104] ''September 15, 1998 Meeting with Engine Manufacturers Association (EMA)'', EPA Memorandum from John W. Mueller, Mechanical Engineer, to docket A–95–27, November 4, 1998. Docket A–95–27, Docket # IV–E–26.

[105] [Reserved]

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 2.0 g/bhp-hr standard recommended by manufacturers seems to indicate that compliance cushions greater than half the standard are needed.

The deterioration factor for the engine and catalyst system in the above analysis would be on the order of four or five.[106] This is extremely high compared to the deterioration factors currently used for certification which are typically between one and two. While EPA understands that current deterioration factors may represent typical deterioration and not severe deterioration, EPA believes that deterioration factors of four or five are unreasonably high and unlikely. EPA would expect a deterioration factor representing more severe operation to be closer to two, which is consistent with manufacturers' previous statements of certifying with certification levels of half the standard to allow for needed compliance margin.

Manufacturers state 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, EPA believes that this assumption is somewhat conservative given the recent developments in catalyst technology, the lead time available, and methods available to protect catalysts under worst case vehicle operation.

Engine-out NO_X levels are also critical to the analysis. In their analysis, manufacturers assumed engine-out NO_X levels of 12 g/bhp-hr, based on manufacturer development data for one engine. EPA does not believe that the engine-out NO_X level of 12 g/bhp-hr is a reasonable or representative assumption. Other available data indicates that several engines have engine-out NO_X emissions well below this level in the 6 to 10 g/bhp-hr range. Also, a previous assessment of engine standards presented to EPA by one manufacturer assumed much lower engine-out NO_X levels.[107] EPA does not believe that the current standards have encouraged manufacturers to place a high priority on engine-out emissions levels. In fact, one manufacturer has removed EGR systems from its engines. For recent engines, catalysts have provided the majority of needed emissions control.

EPA also further considered the engine variability factor of 0.3 g/bhp-hr built into the manufacturers' analysis. The analysis as presented assumes a 12 g/bhp-hr engine-out NO_X level. Manufacturer data for the developmental engine suggests 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 EPA that manufacturers double counted engine variability by using the worst case engine data and an engine variability factor. Using engine-out NO_X levels of 12 g in the analysis but without the engine variability factor yields a NO_X + 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, according to the following assumptions and methodology.

Combined NMHC + NO_X Standard = 1.0 g/bhp-hr
Engine-Out NO_X level (worse-case) = 12 g/bhp-hr
Safety Margin = 20 % (NO_X level) (eq. 1)
NMHC Level = 14.8 % (NO_X Level) (eq. 2)
Combined NMHC + NO_X Standard = NO_X Level + NMHC Level (eq. 3)
NO_X Level = Post-catalyst NO_X rate + Safety Margin (eq. 4)
Post-catalyst NO_X rate = (1-Conversion Efficiency) x Engine-Out NO_X level (eq. 5)

(Step 1) Equation (3) can be solved for NO_X Level—Combined NMHC + NO_X Standard = NO_X Level + NMHC Level 1.0 g/bhp-hr = NO_X Level + 0.148 NO_X Level NO_X Level = 0.871 g/bhp-hr

(Step 3) Placing the results from Step (1) and Equation (1) into Equation (4), and solving for Post-catalyst NOx rate gives—NO_X Level = Post-catalyst NO_X rate + Safety Margin 0.871 g/bhp-hr = Post-catalyst NO_X rate + 0.2 × 0.871 g/bhp-hr Post-catalyst NO_X rate = 0.697 g/bhp-hr

(Step 4) Placing the results from Step (3) into Equation 5 and solving for Conversion Efficiency gives:

Post-catalyst NO_X rate = (1-Conversion Efficiency) × Engine-Out NO_X level
0.697 g/bhp-hr = (1—Conversion Efficiency) × 12 g/bhp-hr
Conversion Efficiency = 0.94 = 94%

EPA believes that the proposed standards would require manufacturers to focus some effort on engine-out emissions control and that engine-out NO_X levels in the 6 to 8 g/bhp-hr range are reasonably achievable. Some engines are already in this range. For other engines, some recalibration of engine systems including the EGR system and perhaps some modest hardware changes to those systems would be necessary. EGR plays a key role in reducing engine-out NO_X, and system redesign may allow more effective use of this technology.

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 NO_X 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. EPA believes these margins are sufficient considering the analysis is also based on worst case catalyst efficiencies.

To help address phase in concerns that could arise for manufacturers, EPA is proposing a modified ABT program for engines, as described above. The ABT program can be an important tool for manufacturers in implementing a new standard. The program allows manufacturers to comply with the more stringent standards by introducing emissions controls over a longer period of time, as opposed to during a single model year. Manufacturers plan their product introductions well in advance. With ABT, manufacturers can better manage their product lines so that the new standards don't interrupt their product introduction plans. Also, the program also allows manufacturers to focus on higher sales volume vehicles first and use credits for low sales volume vehicles. EPA believes manufacturers have significant opportunity to earn credits in the pre-2004 time frame.

Considering all of these factors, EPA believes that the 1.0 g/bhp-hr NMHC+NO_X standard is an appropriate standard for HD Otto-cycle engines in the 2004 time frame; however, we are requesting comment on a standard in

[106] During developmental testing the deterioration factor is determined by dividing the full life emissions level for an engine by the low mileage emissions level. The low mileage level of the certification engine is then multiplied by the deterioration factor to predict full life emissions.

[107] The engine-out data and the details of this analysis are considered Confidential Business Information.

[108] [Reserved]

the range of 1.0 to 1.5 g/bhp-hr. Certification levels of 0.5 g/bhp-hr NMHC+NO_X have been achieved on recently introduced engines of varied sizes. EPA believes that the proposed standard provides sufficient opportunity for manufacturers to maintain a reasonable compliance margin. As manufacturers continue with normal product plans between now and 2004, improved engines will continue to replace older models. The ABT program is available for manufacturers who have not completely changed over to new engine models by 2004. ABT provides manufacturers with the opportunity to earn credits prior to 2004 and use the credits to continue to offer older engine models that have not yet been redesigned or retired by 2004.

EPA requests comments on the above analyses and directs the reader to the Regulatory Impact Analysis for further detail on technological feasibility. EPA continues to seek further information on emissions control and engine system capability and durability. EPA requests comment on the feasibility of the proposed standards and requests data which would help the Agency further evaluate advanced system durability.

4. Onboard Refueling Vapor Recovery

EPA believes that today's proposed ORVR requirements are technologically feasible. In its previous ORVR rulemaking, EPA elected to apply ORVR requirements only to LDVs and LDTs (*see* 59 FR 16262, April 6, 1994). As previously discussed in the section on the proposed ORVR standards, EPA chose at the time of the original rulemaking not to apply ORVR to HDVs because of concerns over secondary manufacturers, different fuel tank designs for larger HDVs than for LDVs and LDTs, and the fact that HDVs are certified under an engine-based testing program. These three issues are addressed in section IV.E.4.b) of this preamble. In the original ORVR rule, however, EPA analyzed the potential application of ORVR to all HDVs. In that analysis EPA concluded that ORVR is technologically feasible for application to HDVs. EPA concluded that the systems which would be required for the covered subset of HDVs would be essentially the same as those for LDVs and LDTs. Such systems have already been successfully implemented on a portion of the LDV fleet. The Agency is aware of no information on fundamental changes to HDV fuel system design which would cause it to believe that the original analysis is no longer valid. EPA requests comment on this view.

ORVR systems must meet certain basic requirements in order to be effective at controlling refueling emissions. In general, they must provide for the routing of displaced vapors from the fuel tank to the engine rather than allowing them to escape uncontrolled to the atmosphere. This will likely be accomplished through the use of 1) a fillneck seal which prevents the vapors from escaping out the fillneck, 2) a fuel tank vent mechanism, to allow for the controlled routing of the vapors from the fuel tank, 3) vapor lines for transporting vapors, 4) a canister containing activated carbon to temporarily store the vapors, and 5) a purge system to regenerate the canister and route the vapors to the engine.

The major components of an ORVR system are already in place on HDVs in response to EPA's enhanced evaporative emission requirements (*see* 58 FR 16002, March 24, 1993). The primary differences between an enhanced evaporative control system and an ORVR system lie in the need to prevent vapors from escaping via the fillneck during a refueling event, and the fact that the vapor flow rates out of the fuel tank are much higher during refueling than during vehicle operation and diurnal events that enhanced evaporative systems are designed to control. A complete discussion of the major components of an ORVR system and how they differ from those in a system designed to comply with the enhanced evaporative requirements is contained in the Regulatory Impact Analysis.

C. On-Board Diagnostics

For Otto-cycle vehicles and engines, the most difficult monitors to implement are those for the catalyst system, the evaporative emission control system, and engine misfire. While each of these monitors poses technological challenges, none of them pose technological feasibility concerns. Rather than concerns over technological feasibility, EPA expects concerns, where today's proposal applies to Otto-cycle vehicles and engines, over resource constraints for OBD calibration and associated verification testing.

EPA does not consider resource constraints a feasibility issue, nor does EPA believe the manufacturers will be constrained by today's OBD provisions. EPA believes this is true for both the Otto-cycle and the diesel OBD requirements. Since the 1996 model year, manufacturers have been equipping their vehicles and engines with OBD systems essentially identical to those being proposed today. This is true federally for all vehicles above 8500 pounds GVWR, and in California for all vehicles and engines above 14,000 pounds GVWR. The Agency believes that the four year lead time within today's proposal matched with the OBD phase-in of 40/60/80/100 percent provides adequate lead time to apply the real world tested OBD system technology to their new sales fleet above 14,000 pounds GVWR without resource difficulties.

The transmission represents an area of potential concern for engine certified as opposed to chassis certified Otto-cycle and diesel engines. Typically, the engine manufacturer certifies and sells its engine, without an associated transmission, to a chassis manufacturer. The chassis manufacturer then ''mates'' the engine to a transmission purchased from a transmission manufacturer representing a third industry party. The regulations proposed today require that chassis certified systems employ transmission diagnostics, but would not require that engine certified systems employ transmission diagnostics.

EPA believes that it is reasonable to expect that electronically controlled transmissions will be designed with some level of diagnostics to ensure proper operation. In addition, the Agency expects that those transmissions will utilize industry standard communication protocols allowing the transmission and the engine control computers to communicate, and allowing any transmission-related OBD codes to be downloaded via the standard diagnostic data link connector without engine manufacturer involvement. If either of these expectations is inaccurate, EPA requests information concerning the likely operational characteristics of electronic transmissions. If EPA's expectations are accurate, we request comment on the appropriateness of the engine certified OBD requirements, Otto-cycle and diesel, being limited to engine diagnostics, and simply requiring that transmissions comply with industry standard communication protocols.

Specific to diesel vehicles and engines, the Agency believes there are three areas of concern associated with technological feasibility: EGR monitoring; misfire monitoring; and, aftertreatment monitoring. With respect to EGR monitoring, the primary concern is expected to be the cooling componentry of a cooled EGR system. Other aspects of the EGR system, such as activation of the EGR valve, verification of proper flow, etc., can be accomplished as is already being done on Otto-cycle and diesel vehicles and engines under 14,000 pounds GVWR.[109] However, the cooling system presents a new challenge. The Agency believes monitoring of the cooling system is feasible by employing temperature sensors to ensure proper EGR cooling (heat transfer) given existing engine conditions, and coolant flow. If the cooling system becomes fouled, its ability to transfer heat from the exhaust gases to the coolant will be diminished and a resultant temperature inconsistency should be observed. Likewise, if coolant ceases to flow through the cooling system, a resultant temperature inconsistency should be observed. In fact, EPA believes that manufacturers will monitor EGR cooling system performance absent a requirement to do so. As discussed in Chapter 3 of the Draft Regulatory Impact Analysis for today's proposal, manufacturers will be designing their EGR systems to cool the EGR to specific design targets to optimize engine performance and to minimize condensation of sulfuric acid. The only way to ensure that engine performance is being optimized is to monitor the performance of the EGR system and compare it to the specific design targets.

As for diesel misfire monitoring, the Agency believes that the proposed requirement is technologically feasible. In fact, manufacturers are certifying compliant diesel misfire monitors for sale in California on vehicles and engines under 14,000 pounds GVWR. We believe, like CARB, that diesel misfire is an air quality concern. Also, we believe that most users of diesel vehicles and engines under 14,000 pounds GVWR, particularly vehicles and engines less than 10,000 pounds GVWR, will not notice or may ignore diesel misfires. In contrast, we believe that most users of engines above 14,000 pounds GVWR will notice and not ignore misfires. We believe this is true because most of these engines are driven by professionals for whom minimizing fuel consumption and maximizing engine performance is a primary business concern. Conversely, most vehicles and engines under 14,000 pounds GVWR, particularly vehicles and engines under 10,000 pounds GVWR, are driven by individuals as personal transportation or for small business use. Such drivers are probably less familiar with the day-to-day operating characteristics of their engines and are probably less concerned with fuel consumption and engine performance. Nonetheless, we are interested in comments on the misfire monitoring requirements of today's proposal. In addition, we request data, such as warranty data, showing misfire rates and possible differences between engines above and below 14,000 pounds GVWR.

With respect to diesel catalyst monitoring, the Agency expects such monitoring to be conducted using temperature sensing devices to detect an exotherm within the aftertreatment device. The Agency requests comment on this expectation and on the probable magnitude of the exotherm. Comments should consider whether limiting the operating modes during which the exotherm is measured (for example, during steady-state operation at a specific engine load, etc.) might increase the accuracy of the monitoring method. Comments should also consider whether, given the provision for back pressure monitoring in lieu of performance monitoring provided test data demonstrate that emissions will not exceed today's proposed malfunction threshold, manufacturers will even have to employ diesel catalyst emission performance monitors. The Agency expects manufacturers to demonstrate that emissions will not exceed the malfunction thresholds, even with the aftertreatment device removed, and then employ the more basic back pressure sensor. This back pressure sensor is intended to indicate the presence of the aftertreatment device. While the back pressure sensor cannot directly detect the performance characteristics of the aftertreatment device, it nonetheless provides some level of assurance that emissions are being controlled due to the presence of the device. The Agency requests comment on the diesel aftertreatment monitoring requirements and data on feasibility, and comment on the appropriateness of the diesel aftertreatment presence detection requirement. The Agency also requests comments and supporting data on the durability of diesel aftertreatment devices.

Note that, for diesel vehicles and engines, the Agency considers the EGR system to be the primary emission control system that will be used to meet the 2004 standards. This makes the EGR system somewhat analogous to the catalyst in an Otto-cycle emission control system. Because the Otto-cycle catalyst is responsible for roughly 90 percent of emission control, the Agency considers it imperative that the catalyst be monitored via OBD to ensure its continued performance. Likewise, the diesel EGR system is expected to account for roughly 50 percent of the emission control, making it perhaps the single largest contributor to emission control on a diesel engine. Therefore, the Agency considers it imperative that the EGR system be monitored on a diesel vehicle or engine. This is especially true given what the Agency considers to be a rather low cost associated with today's proposed requirement for monitoring this critical emission control system.[110] The Agency fully expects that manufacturers will employ OBD techniques on their diesel EGR systems to ensure satisfactory engine performance for their customers. Today's proposal simply ensures that the monitoring will occur, and it ensures that the monitoring will consider not only engine performance, but also emission performance.

VII. What Are the Environmental Benefits of This Proposal?

A. 2004 Emission Standards for Heavy-Duty Diesel Engines

In Chapter 6 of the draft Regulatory Impact Analysis, EPA provides a detailed explanation of the methodology used to determine the environmental benefits from heavy-duty diesel engines associated with this proposal. EPA requests comment on all aspects of the emissions inventory analysis. The following discussion gives a general overview of the methodology and results.

In the 1997 rulemaking, EPA's emission inventory modeling assumed that all HDDE's which would certify to the future 2004 standards would be meeting those standards in-use, under all operating conditions, i.e., EPA was not aware of the high NO_X emissions being emitted by certain HDDE's under certain operating conditions. The supplemental standards and testing provisions will help assure that assumptions used for the 1997 rulemaking are realized. Therefore, the emission inventory modeling discussed below and in the draft RIA for today's rule uses the same methodology as the 1997 rule, including the same emission factors. For this reason, the emission benefits are similar in magnitude to the estimates from the 1997 rulemaking. In addition, the emission estimates presented here do not include the large, previously unknown, excess emissions from engines manufactured from 1988 to 1998.

[109] Current EGR monitoring systems may use the existing intake air temperature sensor—opening the EGR valve should result in an increased intake air temperature. Systems may also use an intake air pressure sensor—opening the EGR valve will change the intake air pressure.

[110] The Agency estimates $3 to $7 per vehicle/engine for today's proposed OBD requirements, primarily for development and demonstration testing given that most of the diesel monitoring will be done by the manufacturer absent any requirement to do so.

We did not include the excess emissions in the modeling for this proposal. While the impact from these previously produced engines would affect the total estimate of the emission impact from the in-use fleet of HDDE in 2004 and beyond, it would not impact the predicted emission benefit resulting from the lowering of the 1998 standard to the 2004 standards, because the predictions for both standards properly do not include these excess emissions. It is this emission reduction which is important for this rulemaking. In the future, the Agency will be making the necessary changes to future versions of the official EPA mobile source emission factor model (currently known as MOBILE 5) to reflect the increased NO_X emission factors from the engines affected by the consent decrees.

The inventory analysis performed for this proposal builds on the inventory analysis associated with the 1997 FRM for heavy-duty diesel engines.[111] However, EPA made some modifications to the 1997 inventory analysis due to recent studies that have been performed with the intent of improving the understanding of the emissions impact of mobile sources. These modifications included new estimates for conversion factors (bhp-hr/mile), scrappage rates, and vehicle miles traveled. The Draft RIA discusses the recent studies and their effects on the calculated HDDE emissions inventories.

To determine total emissions by calendar year, EPA multiplied the emission factor times the total vehicle miles traveled (VMT) in that year. The emission factors were determined using EPA's emission factor model (MOBILE5) for NMHC and NO_X with adjustments for the new scrappage rates, conversion factors, and VMT distribution. Although NMHC and NO_X are proposed to be combined as a single standard, EPA believes that it is useful to model NMHC and NO_X separately. Given the technologies that are expected to be used on heavy-duty diesel engines to comply with the proposed standards, we believe it is reasonable to model the fleet-average impact of the proposed standards as being equivalent to a 2.0 g/bhp-hr NO_X standard and a 0.4 g/bhp-hr NMHC standard.

Table 13 shows the national projections of total NMHC and NO_X emissions and the estimated NO_X benefits for selected years. The emissions are projected to decline over the next several years, due to implementation of stricter controls, but then begin to increase due to growth in the number of vehicle miles traveled, unless there are additional controls. By the year 2015, without these additional controls, total national NO_X emissions are projected to exceed current levels. Figure 5 presents the national projections of total NMHC plus NO_X with and without the proposed engine controls.

TABLE 13.—ESTIMATED NATIONAL NMHC AND NO_X EMISSIONS AND PROPOSED BENEFITS FROM HEAVY-DUTY DIESEL VEHICLES

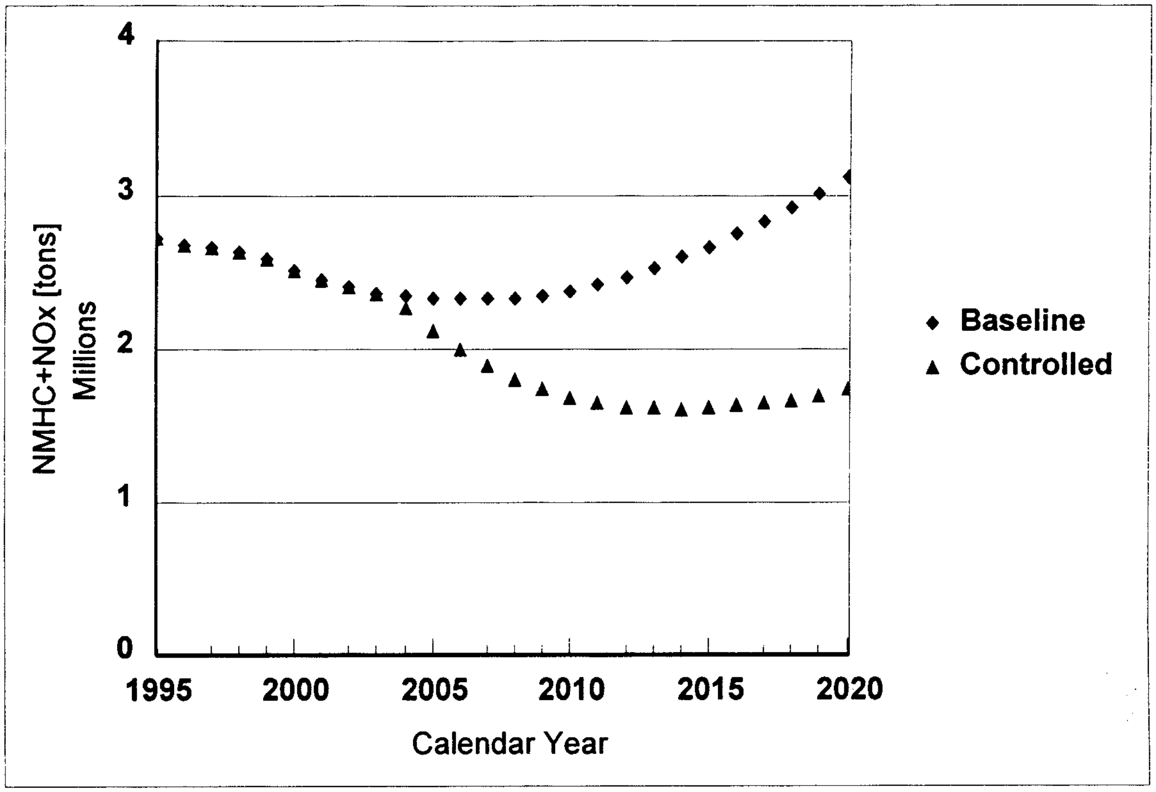
[Thousand short tons per year]

Year	NMHC			NO_x		
	Baseline	With controls	Benefit	Baseline	With controls	Benefit
2005	198	196	3	2,136	1,933	203
2010	184	174	10	2,191	1,504	686
2015	197	182	15	2,479	1,433	1,046
2020	225	205	20	2,900	1,535	1,365

BILLING CODE 6560–50

[111] ''Control of Emissions of Air Pollution from Highway Heavy-Duty Engines; Final Rule,'' 62 FR 54694–54730, October 21, 1997.

Figure 5 – Projected National NMHC Plus NOx Emission Inventory for HDDEs



BILLING CODE 6560–50–C

Although this proposal does not require reductions in direct PM emissions, the proposed standards are expected to reduce the concentrations of secondary PM. Secondary PM is formed when NO_X reacts with ammonia in the atmosphere to yield ammonium nitrate particulate. EPA estimates that the 1.4 million tons per year total NO_X reduction projected for HDDEs in 2020 would result in about a 56,000 tons per year reduction in secondary PM. This calculation is described in the Draft RIA, Chapter 6, Section V.B. It should be noted that these estimates include a calculation involving weighting of the southern California conversion rate by VMT, but the Federal standards do not regulate new vehicles sold in California. Therefore, these nationwide estimates are somewhat over estimated. We intend to address this issue in the final rule.

The term ''hydrocarbons'' includes many different molecules. Speciation of the hydrocarbons would show that many of the molecules are those which are considered to be air toxics including benzene, formaldehyde, acetaldehyde, and 1,3-butadiene. Hydrocarbons from a HDDE include approximately 1.1 percent benzene, 7.8 percent formaldehyde, 2.9 percent acetaldehyde, and 0.6 percent 1,3-butadiene. Therefore, the 20,000 tons per year reduction in NMHC projected for 2020 would result in about a 2,400 tons per year reduction in air toxics. This is discussed in more detail in the Draft RIA.

EPA also believes the proposed regulations will tend to reduce noise. One important source of noise in diesel combustion is the sound associated with the combustion event itself. When a premixed charge of air and fuel ignites, the very rapid combustion leads to a sharp increase in pressure, which is easily heard and recognized as the characteristic sound of a diesel engine. The conditions that lead to high noise levels also cause high levels of NO_X formation. Fuel injection changes and other NO_X control strategies therefore typically reduce engine noise.

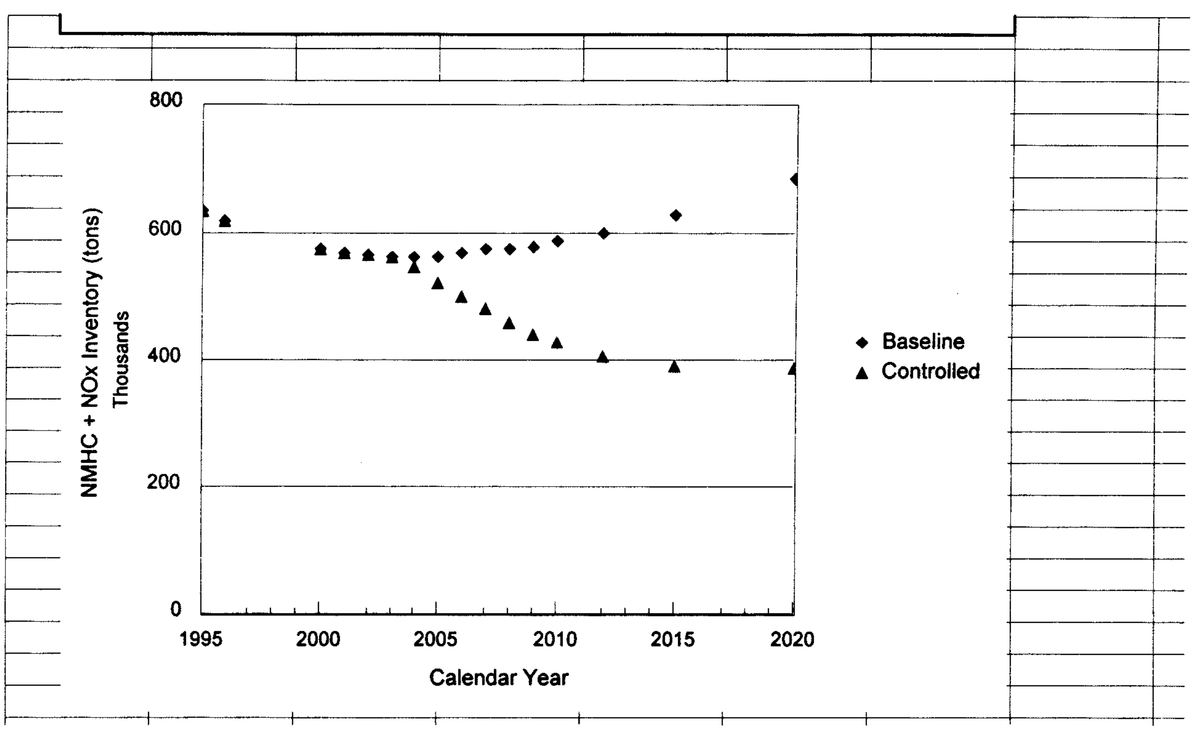
B. 2004 Emission Standards for Heavy-Duty Otto-Cycle Vehicles and Engines

In evaluating the environmental impact of the proposed heavy-duty gasoline engine and vehicle standards, EPA developed estimates of exhaust NO_X and NMHC inventories from HDGVs (excluding California, Alaska, and Hawaii) both with and without the effect of the proposed standards. Full details of the environmental impact analysis can be found in Chapter 7 of the draft RIA for today's proposal. The following paragraphs summarize the key results. The public is encouraged to read the full analysis and to comment on all aspects of the work.

Figure 6 shows the projections of nationwide exhaust NMHC+NO_x emissions from HDGVs both with and without the proposed controls. Table 14 contains the estimated NO_x and NMHC exhaust emission inventories and reductions due to the proposed heavy-duty gasoline engine and vehicle standards. The NO_x inventory for HDGVs is projected to increase from current levels without further controls. With implementation of the proposed standards, the exhaust NO_x emissions from HDGVs are expected to decrease from the baseline by 38 percent by the year 2010 and 61 percent by the year 2020. Exhaust NMHC emissions are projected to decline over the next several years, but then begin to increase beginning around 2010. With implementation of the proposed standards, the exhaust NMHC emissions from HDGVs are expected to decrease from the baseline by 8 percent by the year 2010 and 13 percent by the year 2020.

BILLING CODE 6560–50–P

Figure 6 – Projected NMHC plus NOx Emission Inventory for HDGVs



BILLING CODE 6560–50–C

TABLE 14.—ESTIMATED NO_X AND NMHC INVENTORIES AND REDUCTIONS FROM THE PROPOSED EXHAUST STANDARDS FOR HEAVY-DUTY GASOLINE ENGINES AND VEHICLES

[Thousand tons per year]

Year	NMHC			NO_X		
	Baseline	With controls	Reduction	Baseline	With controls	Reduction
2005	236	232	4	329	290	38
2010	225	208	17	365	223	142
2015	236	209	27	394	183	212
2020	255	221	34	432	168	264

In a similar fashion to that noted for the heavy-duty diesel engine standards, the NO_X reductions from HDGVs are expected to result in reduced secondary PM concentrations. EPA estimates that the 264,000 tons of NO_X reduction in 2020 would result in approximately a 10,000 tons per year reduction in secondary PM. This calculation is described in the draft RIA, Chapter 6, Section V(B), and Chapter 7, Section IV. As noted above, these estimates include a calculation involving weighting of the southern California conversion rate by VMT, but the Federal standards do not regulate new vehicles sold in California. Therefore, these nationwide estimates are somewhat over estimated. We intend to address this issue in the final rule.

C. Benefits of the Supplemental Standards and In-Use Control Measures of Today's Proposal

The supplemental standards and in-use control measures of today's proposal are expected to play an integral role in achieving the emission reductions expected from the 2004 diesel and Otto-cycle standards. These measures include the new supplemental standards and test procedure requirements for diesel engines, the OBD requirements for vehicles and engines below 14,000 lbs GVWR, and the in-use testing requirements for Otto-cycle vehicles below 14,000 lbs GVWR.

These measures are considered vital, as a whole, to assuring that the full benefits of the 2004 standards are being achieved. The new supplemental standards and test procedure requirements will ensure that engines are designed to meet the appropriate standards under a broad range of operating conditions. The in-use testing requirements will ensure that engines meet the appropriate standards throughout their useful lives. Finally, the OBD requirements will help ensure that engines in-use continue to operate according to design intent and that designs are durable and robust in the field. If vehicles and engines malfunction or deteriorate in ways that are not noticed by the driver, emissions may be far above the design intent of the engine or vehicle for thousands, if not tens of thousands of miles. On-board diagnostic systems are uniquely suited to identify such malfunctions. Such identification serves to ensure that the engines and vehicles continue to operate as designed, thereby ensuring they continue to provide the air quality benefits expected by the new standards.

For example, we expect widespread use of EGR to comply with the 2004 diesel standards. The emission reduction from the EGR system will likely be as high as 50 percent, that is, the engine out emissions will be cut in half as a result of the EGR system. Should the EGR system malfunction, the emissions could essentially double, and the driver would probably not be aware of the malfunction without an OBD detection. The same could be true for Otto-cycle vehicles and engines, in which case the primary emission control technology will be the catalyst, which is responsible for as much as 90 percent of the emission control. Should the catalyst deteriorate or fail, emissions could increase from 150 percent to 900 percent.[112] Similar statements can be made in regards to evaporative leak detection monitors. We know that emissions from leaking evaporative systems can be very large. In their most recent Staff Report on the OBDII program, the California Air Resources Board states that data from current evaporative system designs show that leaks approaching a 0.020 inch hole begin to rapidly generate excess evaporative emissions (up to 15 times the standard, which equates to 30 grams per test).[113] The emissions from a heavy-duty Otto-cycle vehicle, having a fuel tank well over 15 gallons, would likely be even higher. Without the OBD system, those emissions would probably never be identified and the malfunctions would probably never be repaired.

Further, the primary goal of OBD is to provide the industry with an additional incentive to improve emission control system durability. OBD serves that goal by encouraging durable components and systems in order to avoid the OBD detection and MIL illumination that will result upon their malfunction. Indeed, the light-duty industry has expressed on numerous occasions that their primary goal with respect to OBD is to avoid MIL illumination because of the adverse way they expect their customers to react.[114] Therefore, the presence of the OBD system is expected not only to identify malfunctions and deterioration, but also to minimize their occurrence.

Benefits such as those described above are not easily quantified, but are critical to the success of our program as a whole. Without any one of these compliance and in-use control measures, the benefits of today's proposal could be diminished.

VIII. What Are the Economic Impacts of the Proposal?

A. 2004 Emission Standards for Heavy-Duty Diesel Engines

1. Expected Technologies

In assessing the economic impact of the 2004 emission standards (including the standards finalized in 1997 and the standards proposed today), EPA has used a current best judgement of the combination of technologies that an engine manufacturer might use to meet the new standards at an acceptable cost. Full details of EPA's cost analysis, including information not presented here, can be found in the Draft

[112] Assuming a properly operating catalyst conversion efficiency of 90 percent, and a deteriorated conversion efficiency of anywhere from 75 percent down to 0 percent, which would lead to a 150 percent to 900 percent emission increase, respectively.

[113] Staff Report: Initial Statement of Reasons for Rulemaking—Technical Status and Proposed Revisions to Malfunction and Diagnostic System Requirements for 1994 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines (OBD II); October 25, 1996.

[114] Stated more appropriately, their primary goal is to avoid MIL illumination while still complying with the OBD requirements.

Regulatory Impact Analysis in the public docket. The costs presented here were developed assuming that heavy-duty diesel engines would need high-flow cooled EGR, combustion chamber optimization, improved electronic fuel injection, and variable geometry turbochargers (except for light heavy-duty engines). The costs also include testing costs necessary to comply with the OBD and not-to-exceed requirements.

The analysis also assumes that manufacturers would introduce the improved electronic fuel injection systems and variable geometry turbochargers for some engine models even without the more stringent standard in 2004. Both of these technologies will provide significant performance benefits both directly, and by allowing manufacturers to reduce the use of injection timing retard to comply with the current 4.0 g/bhp-hr NO_X standard. The Agency believes that manufacturers may draw similar conclusions for using EGR on some of these same engines, however, as a conservative assumption, EPA is assuming that no EGR would be used to comply with the current 4.0 g/bhp-hr NO_X standard. For this analysis EPA is also assuming that only 50 percent of the costs for the improved electronic fuel injection and the use of variable geometry turbochargers are attributable to emission control. This is because EPA believes that manufacturers would make these improvements for many of their engines, even in the absence of these emission standards, to reduce fuel consumption and improve engine performance, a similar approach was used in the 1997 final rule. The docket for this rulemaking contains additional information on this aspect of the Agency's cost analysis, including a cost sensitivity analysis regarding the fifty percent assumption.[115] The Agency requests comment on this approach which we intend to revisit in the final rule if appropriate. In addition, Chapter 8, Section IV of the draft RIA for this proposal contains an estimate of the impact this 50 percent assumption has on the HD diesel cost-effectiveness. We recognize this 50 percent assumption is not a precise approach to characterizing the costs which could otherwise be attributed to our baseline assumptions. However, developing a more precise estimate is problematic due to the complexity of market demand as well as other uncertainties. Nevertheless, we intend to consider developing a more precise estimate of the baseline for the final rule analysis. In addition, it may be more appropriate to consider performance benefits (improved fuel economy, drive-ability) with the other secondary benefits rather than with costs, and we intend to reconsider this issue for the final rule. EPA also requests comment regarding how the early introduction of these technologies would affect compliance costs. EPA also requests comment on whether variable geometry turbochargers can serve the function of exhaust braking for heavy heavy-duty engines, and what cost savings this would provide for manufacturers.

2. Per Engine Costs

Estimated per engine cost increases are broken into purchase price and total life-cycle operating costs. The incremental purchase price for new engines is comprised of variable costs (for hardware and assembly time) and fixed costs (for R&D, retooling, and certification). Total operating costs include expected increases in maintenance. Cost estimates based on these projected technology packages represent an expected incremental cost of engines in the 2004 model year. Costs in subsequent years would be reduced by several factors, as described below. Separate projected costs were derived for engines used in three service classes of heavy-duty diesel engines. All costs are presented in 1995 dollars. Life-cycle costs have been discounted to the year of sale.

The costs of the technologies necessary for meeting the 2004 model year standards are itemized in the Draft Regulatory Impact Analysis and summarized in Table 8. These estimated costs are higher than those estimated for the previous FRM because they include costs for variable geometry turbochargers and full use of high-flow cooled EGR, as well as small additional costs for the new OBD and compliance testing requirements. For light heavy-duty vehicles, the cost of a new 2004 model year engine is estimated to increase by $428 (compared to the previous estimate of $258). For medium heavy duty vehicles the purchase price of a new engine is estimated to increase by $593 (compared to the previous estimate of $397). Similarly, for heavy heavy-duty engines, the initial purchase price is expected to increase by $707 (compared to the previous estimate of $406).

For the long term, EPA has identified various factors that would cause cost impacts to decrease over time. First, the analysis incorporates the expectation that manufacturers will apply ongoing research to making emission controls more effective and less costly over time. This expectation is similar to manufacturers' stated goal of decreasing their reliance on catalysts to meet emission standards in the future. Second, research in the costs of manufacturing has consistently shown that as manufacturers gain experience in production, they are able to apply innovations to simplify machining and assembly operations, use lower cost materials, and reduce the number or complexity of component parts. The analysis incorporates the effects of this learning curve by projecting that the variable costs of producing the low-emitting engines decreases by 20 percent starting with the third year of production (2006 model year) and by reducing variable costs again by 20 percent starting with the sixth year of production. Chapter 4, Section III in the draft RIA for this proposal, as well as Chapter V, Section IV of the final RIA for the 1997 final rulemaking (*see* Docket A–95–27, Docket Item 35#V–B–01) contain additional discussion of the application of this learning curve. The 2004 HD diesel standards will require a fundamental change in technology for the engine manufacturers. Considering this change, we believe the learning curve concept is appropriate for this rulemaking. The Agency requests comments and data regarding the application of this learning curve approach to the heavy-duty diesel industry, including information regarding any observed reduction in manufacturer costs for the past application of similar technology changes for the heavy-duty on-highway industry, or other technology changes to the diesel engine industry as a whole. We also request comment on the learning curve theory. Specifically, we request comment and supporting data regarding the theory that manufacturing costs continues to decrease over time, possibly ad infinitum, albeit at a slower rate as time progresses.

Finally, since fixed costs (excluding in-use testing costs) are assumed to be recovered over a five-year period, these costs are not included in the analysis after the first five model years. Table 15 lists the projected schedule of costs for each category of vehicle over time.

[115] See EPA Air Docket A–98–32, ''Analysis of Costs and Benefits of VGT and Improved Fuel Injection'', EPA Memorandum from Charles Moulis.

TABLE 15.—PROJECTED DIESEL ENGINE COST AND PRICE INCREASES
[1995 Dollars Discounted to Year of Sale]

Vehicle class	Model year	Purchase price increase	Life-cycle operating cost
Light heavy-duty	2004	$428	$7
	2009 and later	221	7
Medium heavy-duty	2004	593	45
	2009 and later	252	45
Heavy heavy-duty	2004	707	96
	2009 and later	324	96

3. Aggregate Costs to Society

The above analysis develops per-vehicle cost estimates for each vehicle class. Using current data for the size and characteristics of the heavy-duty vehicle fleet and making projections for the future, these costs can be used to estimate the total cost to the nation for the new emission standards in any year. The result of this analysis is a projected total cost starting at $424 million (1995 dollars) in 2004. Per-vehicle costs savings over time reduce projected costs to a minimum value of $223 million in 2009, after which the growth in truck population leads to an increase in costs to $285 million in 2020. Total costs for these years are presented by vehicle class in Table 16. The calculated total costs represent a combined estimate of fixed costs as they are allocated over fleet sales, variable costs assessed at the point of sale, and operating costs as they are incurred in each calendar year. Future sales are projected for years beyond 1995, sales are projected to increase each year by a constant value equal to 2 percent of the number of engines sold in 1995. EPA used a similar 2 percent growth estimate for the 1997 rulemaking for HD engines, we request comment and supporting data which would refine this estimate.[116] EPA also requests comment and supporting data on what impact, if any, costs associated with these new standards might have on the sales rate of HD diesel engines in the future. In addition, EPA requests comment on whether or not a 2 percent per year increase specifically for the light-heavy heavy duty diesel market is an appropriate estimate for future growth, considering the recent trend of increasing sales of sport-utility vehicles weighing over 8,500 pounds.

TABLE 16.—ESTIMATED ANNUAL COSTS FOR IMPROVED HEAVY-DUTY VEHICLES
[Millions of dollars])

Category	2004	2009	2020
Light heavy-duty	142	81	95
Medium heavy-duty	198	46	59
Heavy heavy-duty	185	97	130
Total	424	159	97

B. 2004 Emission Standards for Heavy-Duty Otto-Cycle Vehicles and Engines

This section contains a summary of the Agency's comprehensive analyses of the economic impacts of today's proposed regulations for heavy-duty Otto-cycle vehicles and engines. The following separate factors are analyzed: (1) The technologies expected to be used and their projected rates of application; (2) the costs of these technology packages incremental to today's vehicle designs (presented on a per-vehicle basis separately for chassis and engine certified configurations) and; (3) the aggregate cost to society of the proposed requirements. More information on these analyses can be found in the Regulatory Impact Analysis contained in the docket for this rule.

1. Expected Technologies

The various technologies that could be used to comply with today's proposed regulations were previously discussed in the section on technological feasibility. In developing costs for the associated technologies EPA looked at the current technology used on HDVs and compared that to the technology expected to be used to meet the proposed regulations. The incremental costs difference was then calculated based on the differences between the current (*i.e.*, baseline) technology packages and those expected to be used in 2004. Table 17 shows both the current baseline and expected technologies for complete vehicles. Table 18 shows the current baseline and expected technologies for the engine-based standards. These tables only show the technologies which are expected to change in some way from their current design or be applied to different percentages of the fleet than they are currently. Technologies such as sequential multi-port fuel injection and EGR, while important to meeting the proposed standards, are not expected to be fundamentally changed in their design, or be utilized in different percentages of the fleet than they currently are. Thus, such technologies are not included in these tables. However, in some cases the cost of optimizing such technologies is included in the cost estimates.

[116] ''Draft Regulatory Impact Analysis: Control of Emissions of Air Pollution from Highway Heavy-Duty Engines'', Chapter 7, Section II, Available in EPA Air Docket A–95–27, Item # III–B–01

TABLE 17.—CURRENT AND EXPECTED TECHNOLOGY PACKAGES FOR COMPLETE VEHICLE STANDARDS

Technology	Baseline Federal	Estimated 2004
Catalysts	60% single underfloor 40% dual underfloor	13% single enhanced underfloor. 50% dual enhanced underfloor. 37% dual close-coupled and dual enhanced underfloor.
Oxygen sensors	70% dual heated 10% triple heated 20% quadruple heated	13% dual heated. 87% quadruple heated.
ECM	50% 32 bit computers 50% 16 bit computers	100% 32 bit computers.
Adaptive learning	0%	80%
Individual cylinder A/F control	0%	10%
Leak free exhaust	90%	100%
Insulated exhaust	0%	40%
Secondary air injection	20%	30%
ORVR	0%	100% [A]

[A] ORVR is only proposed to apply to complete vehicles 10,000 lbs GVWR and under, and is proposed to be phased in over three years, with 100% application to those vehicles in 2006.

TABLE 18.—CURRENT AND EXPECTED TECHNOLOGY PACKAGES FOR ENGINE-BASED STANDARDS

Technology	Baseline Federal	Estimated 2004
Catalysts	60% single underfloor 40% dual underfloor	13% single enhanced underfloor. 87% dual enhanced underfloor.
Oxygen sensors [A]	70% dual heated 10% triple heated 20% four heated	13% triple heated. 87% quadruple heated.
ECM	50% 32 bit computers 50% 16 bit computers	100% 32 bit computers.
Improved fuel control	50%	100%
Secondary air injection	20%	50%

[A] The estimated breakdown for 2004 reflects OBD requirements for all HDGEs. However, at this time OBD is only proposed to apply to HDGEs under 14,000 lbs GVWR (approximately 60 percent of HDGEs).

2. Per Vehicle Costs

The costs of the projected technologies presented in the previous section are itemized and discussed in detail in the RIA. On a per-vehicle basis these costs are summarized in Table 14. They are presented in two components: purchase price and operating cost. The operating costs only apply to ORVR-equipped vehicles and include the combined effects of a small fuel economy penalty due to the increased weight of the ORVR hardware, and a larger fuel economy benefit resulting from the vehicle being able to utilize fuel vapors that would otherwise escape to the atmosphere in the absence of ORVR.

EPA believes that the manufacturers will recover the fixed costs associated with research and development, tooling and certification over the first five years of production. Thus, these fixed costs are not included in the analysis after the first five model years. We request comment on whether a five-years amortization period is a reasonable estimate. The fixed costs associated with the proposed in-use testing programs will continue indefinitely. The projected per vehicle costs impacts are summarized in Table 19.

TABLE 19.—PROJECTED HDV PRICE AND OPERATING COST INCREASES

Class	Model year	Purchase price increase	Lifetime operating cost
Complete Vehicles	2004 [a]	$302	−$6
	2009 and later	297	−6
Engines	2004 [b]	287	
	2009 and later	248	

[a] This cost includes both ORVR and OBD, which are phased inbeginning with the 2004 model year, but which are not proposed to be required on all complete vehicles until the 2006 model year for ORVR and the 2007 model year for OBD.
[b] This cost includes an OBD hardware cost. OBD requirements are phased in beginning with the 2004 model year, but are not proposed to be required on all engines under 14,000 lbs GVWR until the 2007 model year.

3. Aggregate Cost to Society

In addition to the per vehicle costs just described, EPA also calculated the aggregate cost to society. This was done by combining the per vehicle costs with assumed future sales of HDVs. The results of this analysis are summarized in Table 20. The recovery of most fixed costs results in slightly reduced costs beginning in 2009, after which costs begin to rise in accordance with projected increased sales. The aggregate costs represent a combined estimate of the fixed costs for research and development, tolling and certification as they are allocated over the first five years of sales, variable costs assessed at the point of sale, and operating costs (primarily in the form of fuel cost savings) for ORVR-equipped vehicles (calculated to net present value and applied at the point of sale). Future sales are projected for years beyond 1996, sales are projected to increase each year by a constant value equal to 2 percent of the number of engines sold in 1996. EPA used a similar 2 percent growth estimate for the 1997 rulemaking for HD engines, we request comment and supporting data which would refine this estimate.[117] EPA requests comment and supporting data on what impact, if any, costs associated with these proposed standards might have on the sales rate of HD Otto-cycle engines in the future. We also request comment on whether or not a 2 percent per year increase specifically for the light-heavy heavy duty Otto-cycle market is an appropriate estimate for future growth, considering the recent trend of increasing sales of sport-utility vehicles weighing over 8,500 pounds GVWR.

TABLE 20.—AGGREGATE COST TO SOCIETY OF THE PROPOSED HEAVY-DUTY OTTO-CYCLE REQUIREMENTS

Year	Cost ($million)
2004	$124
2009	151
2020	177

IX. What is the Cost-Effectiveness of the Proposal?

A. 2004 Emission Standards for Heavy-Duty Diesel Engines

EPA has estimated the per-vehicle cost-effectiveness (i.e., the cost per ton of emission reduction) of the model year 2004 NMHC+NO_X standards over the typical lifetime of heavy-duty diesel vehicles covered by today's rule. The RIA contains a more detailed discussion of the cost-effectiveness analyses. As described above in the cost section, the cost of complying with the standards will vary by model year. Therefore, the cost-effectiveness will also vary from model year to model year. For comparison purposes, the discounted costs, emission reductions and cost-effectiveness of the standards are shown in Table 21 for the same model years discussed above in the cost section. The cost-effectiveness results contained in Table 21 present the range in cost-effectiveness resulting from the two cost-effectiveness scenarios described above.

TABLE 21.—DISCOUNTED PER-VEHICLE COSTS, EMISSION REDUCTIONS AND COST-EFFECTIVENESS OF THE NMHC+NO_X Standard

Vehicle class	Model year	Discounted lifecycle costs	Discounted lifetime reductions (tons)		Discounted cost-effectiveness ($/ton)
			NO_X	NMHC	
Light Heavy-Duty Diesel vehicles	2004	$435	0.310	0.004	$1380
	2009 and later	228			725
Medium Heavy-Duty Diesel vehicles	2004	638	0.872	0.012	720
	2009 and later	296			335
Heavy-Duty Diesel Vehicles	2004	803	3.401	0.048	230
	2009 and later	420			120
Overall (For All Heavy-Duty	2004	....	....	....	400
	2009 and later				200

In addition to the benefits of reducing ozone within and transported into urban ozone nonattainment areas, the NO_X reductions from the new engine standards are expected to have beneficial impacts with respect to crop damage, secondary particulate, acid deposition, eutrophication, visibility, and forest health. Due to the difficulty in accurately quantifying the monetary value of these societal benefits, the cost-effectiveness values presented do not assign any numerical value to these additional benefits. EPA requests comments on all aspects of the cost-effectiveness analysis for heavy-duty diesel engines.

B. 2004 Emission Standards for Heavy-Duty Otto-Cycle Vehicles and Engines

EPA has estimated the per-vehicle cost-effectiveness (i.e., the cost per ton of emission reduction) of the proposed NMHC plus NO_X emission standards over the lifetime of typical heavy-duty gasoline vehicles. The RIA contains a more detailed discussion of the cost-effectiveness analysis. EPA requests comments on all aspects of the cost-effectiveness analysis for heavy-duty gasoline engines and vehicles. EPA plans to conduct cost-effectiveness analyses of alternatives to the proposed Otto-cycle standards in the final rule based on comments received as appropriate.

As described above, the cost of complying with the proposed standards will vary by vehicle category (i.e., a complete Class 2b heavy-duty gasoline vehicle, a complete Class 3 heavy-duty gasoline vehicle, or an incomplete heavy-duty gasoline vehicle) and model year. Therefore, the lifetime cost-effectiveness of the proposed standards will vary by model year. For comparison purposes, the discounted lifetime costs, emission reductions (in short tons), and cost-effectiveness of the proposed standards are shown in Table 22 for the same model years discussed in the Economic Impact section.

[117] "Draft Regulatory Impact Analysis: Control of Emissions of Air Pollution from Highway Heavy-Duty Engines", Chapter 7, Section II, Available in EPA Air Docket A–95–27, Item # III–B–01.

TABLE 22.—COST-EFFECTIVENESS OF THE PROPOSED STANDARDS FOR HEAVY-DUTY GASOLINE VEHICLES

HDGV category	Year of production	Discounted lifetime cost	Discounted lifetime $NMHC+NO_X$ Reduction (tons)	Discounted lifetime cost-effectiveness ($/ton)
Class 2B Complete	1	$296	0.56 tons	$530
	6 and later	291		520
Class 3 Complete	1	296	0.55	530
	6 and later	291		520
Incomplete HDGV	1	287	0.61	480
	6 and later	248		410
All HDGVs	1	294	0.57	520
	6 and later	281		490

EPA has also estimated the cost-effectiveness of the proposed ORVR for Class 2B heavy-duty gasoline vehicles. Table 23 contains the discounted lifetime cost-effectiveness of the proposed ORVR requirements.

TABLE 23.—DISCOUNTED, LIFETIME COST-EFFECTIVENESS OF THE PROPOSED ORVR REQUIREMENTS FOR CLASS 2B HEAVY-DUTY GASOLINE VEHICLES

Year of production	Discounted lifetime cost	Discounted lifetime NMHC NO_X Emission Reductions (tons)	Discounted lifetime cost-effectiveness ($/ton)
1	$5	0.035	$130
6	2	0.035	50

In addition to the benefits of reducing ozone within and transported into urban ozone nonattainment areas, the NO_X emission reductions from the proposed heavy-duty gasoline vehicle and engine standards are expected to have beneficial impacts with respect to crop damage, secondary particulate, acid deposition, eutrophication, visibility, and forest health. The cost-effectiveness values presented above do not assign any numerical value to these additional benefits. Based on existing studies that have estimated the value of such benefits in the past, EPA believes that the actual monetary value of the multiple environmental and public health benefits that would be produced by the NO_X reductions under this proposal will be greater than the estimated compliance costs.

X. Are Future Reductions in HD Emissions Possible?

A. Potential Future Standards for Heavy-Duty Diesel Vehicles and Engines

1. Possible Future Reductions in Heavy-Duty Diesel NO_X and NMHC

As discussed in section II (What is the Environmental Need for this Proposal?), heavy-duty vehicles are a major source of national NO_X emissions and a source of NMHC emissions in the U.S., both of which are precursors for tropospheric ozone. Despite the important reductions in NO_X and NMHC which will occur from HD diesel 2004 standards, it is possible that additional reductions in NO_X and NMHC from heavy-duty diesels will be necessary in the future in order for air quality goals to be achieved across the country.

The Agency received written comments from local and state air quality agencies and from several environmental organizations in response to the 2004 $NMHC+NO_X$ proposal in the June 27,1996 NPRM urging the Agency to finalize more stringent NO_X standards for the 2004 model year, or to consider standards resulting in the largest NO_X reduction possible from HD engines. These organizations cited future air quality concerns which would require additional NO_X and NMHC reductions from HD engines and vehicles in the future.[116] Though the Agency did not finalize more stringent standards, the stakeholders' air quality concerns remain.

The HD SOP signed in July, 1995 included a discussion of future research goals for further reductions in NO_X and PM from on-highway HD diesel engines. As described in the SOP, these research goals suggested a target value of 1.0 g/bhp-hr NO_X. In addition, the Agency is aware that the European Union is currently considering a range of HD engine NO_X levels for potential Euro IV emission limits in 2005. At present, the European Union is considering Euro IV NO_X limits ranging from 1.5 to 2.6 g/bhp-hr.

The RIA for this proposal includes a discussion of several promising emission control technologies which may offer the potential for NO_X reductions down to, or even beyond the research goals identified in the SOP. These emission control technologies include lean NO_X adsorption catalysts and urea-based selective catalytic reduction systems (SCR). Each of these technologies have demonstrated significant NO_X reduction capability (up to 75 percent and some projections range up to 90 percent). However, each technology is still under development, and each has its own set of potential difficulties for wide-spread HD application in the U.S. For example, current generation NO_X adsorber catalysts have been shown to be susceptible to fuel sulfur poisoning, and urea-based SCR systems would likely require a national distribution system for urea. In addition, costs, durability, tamper resistance, and in-use emission performance associated with each technology have not been well defined. For this reason, EPA does not believe more stringent standards based on such

[116] See EPA Air Docket A–95–27, Docket Item's IV-D–08, IV-D–15, and IV-D–16.

technology is achievable for the 2004 model year, taking into consideration cost, energy, and safety factors. However, such more stringent standards may be appropriate in later model years, once these technologies are further developed. Furthermore improvement in diesel fuel quality, particularly lower sulfur levels, would likely be needed to enable these technologies. These issues were the subject of the Advance Notice of Proposed Rulemaking on ''Control of Diesel Fuel Quality'' that EPA published in May (64 FR 26142, May 13, 1999).

The Agency requests comment on the need for future reductions in NO_X and NMHC emissions from HD diesel engines, the time frame in which future standards should be considered, and what standards should be considered. In addition, the Agency requests comment and supporting data, including emission testing data, durability data, cost data, and other relevant information, on what technologies may be available for meeting more stringent HD diesel NO_X and/or NMHC levels. The Agency requests comment specifically on the feasibility of these advanced aftertreatment technologies to attain reductions cited above in the 2007 time frame. Finally, the Agency requests comment on what role, if any, diesel fuel quality plays in enabling additional reductions from HD diesel engines.

2. Potential Future Reductions in Heavy-Duty Diesel Engine PM

Section II of this preamble (''What is the Environmental Need for this Proposal?''), includes: a discussion of the adverse health consequences associated with particulate matter; a discussion of the contribution of HD diesel engine PM to national emission inventories; a discussion of several recent source apportionment studies for PM; and a discussion of the negative health impacts associated specifically with diesel exhaust PM, including the potential carcinogenicity of diesel PM. The Agency requests comment on 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.

EPA received written comments from several state and local air quality agencies as well as several environmental organizations regarding the HDDE PM standard in response to the June 27, 1996 NPRM for on-highway heavy-duty engines.[119] In general, these organizations felt that maintaining the current PM standard of 0.1 g/bhp-hr in model year 2004 was not adequate for protection of human health. The commentors stressed the particularly harmful nature of diesel PM, and they believed technology was available to justify a lower PM standard in 2004.

The HD SOP signed in 1995 included a discussion of a HD diesel PM research goal of 0.05 g/bhp-hr. The Agency is also aware that the European Union is currently considering a range of PM levels for potential Euro IV emission limits for HD diesel in 2005. At present, the European Union is considering Euro IV PM limits ranging from 0.015 to 0.04 g/bhp-hr.

The RIA for this proposal includes a discussion of the current state of the art for HDDE control technologies for both NO_X and PM control, as well as the technologies the Agency expects manufacturers to use to meet the 2004 NMHC+NO_X standards. The inverse relationship between in-cylinder[120] NO_X and PM emissions is a well documented phenomenon; in-cylinder modifications which result in lower NO_X tend to result in an increase in PM. As discussed in the RIA, there are technologies available to minimize this inverse relationship, but there are limits to what can be done in-cylinder. Data available to date indicate the 2004 NMHC+NO_X standard and the 0.1g/hp-hr PM standard is near the limit of what can be done utilizing only known in-cylinder technologies (including EGR as an in-cylinder control technology). However, a number of promising aftertreatment technologies may be available for wide spread HD application which could allow manufacturers to meet a PM standard lower than 0.1g/bhp-hr while not negatively impacting NO_X emissions. As discussed in the RIA, these technologies include diesel oxidation catalysts (DOCs) and particulate traps. DOCs have the potential to offer modest levels of PM control (approximately 10–30 percent), and the level of control is dependent on the amount of volatile organic component present in the engine's exhaust PM. Particulate traps have the potential to achieve large reductions in exhaust PM, approaching 80–90 percent reduction. However, dependable regeneration techniques, in-use durability and reasonable cost are some of the important issues which still need to be addressed. In addition, NO_X control technologies such as NO_X adsorber catalysts and SCR systems could potentially allow manufacturers to favor the in-cylinder trade-offs between NO_X and PM for stringent in-cylinder PM control, and rely on aftertreatment to provide NO_X control.

As discussed in section IV.B (''Are Changes in Diesel Fuel Quality Necessary to Meet the 2004 Standards?''), and in more detail in the RIA for this proposal, diesel fuel quality, and in particular, diesel fuel sulfur level, can play an important role in enabling certain PM and NO_X control technologies. Some DOCs and continuously regenerable PM traps, as well as current generation lean NO_X adsorber catalysts can be poisoned by high sulfur levels. Some versions of passively regenerated catalyzed traps and DOCs are not poisoned at current fuel sulfur levels, but can produce large amounts of sulfate PM at current sulfur levels, decreasing their effectiveness. Given this information, EPA has not included more stringent PM standards for the 2004 model year or later in today's proposal. However, the Agency requests comment and supporting data on the air quality need, technical feasibility, and costs associated with implementing more stringent PM standards as early as the 2004 model year. The Agency requests comment specifically on the feasibility of the application of PM traps to achieve up to 90 percent reductions from today's levels. In addition, the Agency requests comment on the range of PM limits currently being considered by the European Union, namely 0.015 to 0.04 g/hp-hr. Finally, the Agency requests comment on what role, if any, diesel fuel quality plays in meeting a more stringent PM standard.

3. Potential Structure of Future Diesel Emission Standards

EPA regulations for heavy-duty vehicles (*i.e.*, vehicles with a GVWR greater than 8500 pounds) have historically been ''fuel-neutral,'' meaning that the same standard applied to both gasoline and diesel vehicles. Today's proposal moves away from that historical approach because we believe there is a case to be made that heavy-duty Otto-cycle engines may be capable of significantly lower emissions than heavy-duty diesel engines given current technology and fuels. In addition to proposing tighter standards for heavy-duty Otto-cycle engines, however, we have also proposed to change the fundamental structure of the compliance program by requiring complete heavy-duty Otto-cycle vehicles up to 14,000 pounds GVWR to be certified to chassis-based standards, rather than the engine-based standards used historically for the entire heavy-duty category. We request comment on

[119] See EPA Air Docket A–95–27, Item's IV–D–03, IV–D–08, IV–D–15, IV–D–19

[120] In-cylinder-an engineering term which refers to engine design changes which affect emissions in the combustion chamber, as compared to aftertreatment device.

these changes to the structure of the EPA emission control program for heavy-duty vehicles and engines and on the desirability of fuel-neutral standards.

There are several structural options that we are likely to consider when we propose future tighter standards for heavy-duty vehicles. Having already taken the step of proposing to move complete heavy-duty Otto-cycle vehicles up to 14,000 pounds GVWR into a chassis-based program with chassis-based standards, we request comment on whether we should consider requiring complete diesel vehicles in the same weight range to meet chassis-based standards, and if so, what appropriate standards might be. Alternatively, the standards could be structured such that complete diesel vehicles up to 10,000 pounds GVWR might be subject to chassis-based standards, while those between 10,000 and 14,000 pounds GVWR could be subject to engine-based standards, as they are today. We request comment on limiting chassis-based standards to diesel vehicles in this manner.

In addition to the type of standards (vehicle- or engine-based) that we might consider in the future for diesel vehicles up to 14,000 pounds GVWR, another key issue is the level of the standards relative to those that apply to Otto-cycle vehicles. This issue is equally applicable to heavy-duty vehicles above and below 14,000 pounds GVWR. In addition to requesting comment on a chassis-based program for some heavy-duty diesel vehicles, we request comment on applying equivalent chassis-based standards to diesel and Otto-cycle vehicles, and on the role that diesel fuel quality might play in meeting such standards. In the context of possible future changes to diesel fuel quality, we believe that it may indeed be appropriate and technically feasible to require some heavy-duty diesel vehicles up to 14,000 pounds GVWR to be subject to the same standards as their Otto-cycle counterparts. In addition to the specific issues raised above, we request comment on general issues of fuel neutrality and structure of emission standards as they might apply to heavy-duty vehicles.

B. Potential Future Standards for Heavy-Duty Otto-Cycle Vehicles

1. Exhaust Emission Standards

California has adopted a new generation of standards for light-duty and medium-duty vehicles, referred to as the LEV-II standards. The new California standards for vehicles above 8,500 pounds GVWR are shown in Table 24. The light-duty standards are phased in beginning in 2004 according to an established phase-in schedule. For heavy-duty vehicles, there is no set phase-in schedule. California requires that 100 percent of HD vehicles comply with the standards shown in Table 24 beginning in MY 2007. While the focus of today's notice is on 2004 standards, EPA is exploring the appropriateness of adopting standards equivalent to those in Table 24 in a future rulemaking. Doing so would allow federal and California standards for heavy-duty Otto-cycle vehicles to continue to be harmonized beyond the 2007 model year. Thus, today EPA requests comment on the feasibility of, cost-effectiveness, and the need for standards such as those shown in Table 24, and on the issues noted above regarding the fuel-neutrality of future emission standards and the possibility of applying equivalent standards to diesel and Otto-cycle vehicles. In addition, any future rulemaking action would likely assess SFTP standards that would apply in conjunction with FTP standards. EPA requests comment on the application of SFTP standards to heavy-duty Otto-cycle vehicles under 14,000 pounds GVWR.

TABLE 24.—CALIFORNIA LEV II FULL-LIFE EMISSION STANDARDS FOR 2007 AND LATER MODEL YEAR VEHICLES OVER 8,500 POUNDS GVWR

[Grams per mile]

Vehicle weight category (GVWR)	Nonmethane organic gas	Oxides of nitrogen	Carbon monoxide
8,500—10,000 lbs	0.195	0.2	6.4
10,001—14,000 lbs	0.23	0.4	7.3

2. Evaporative standards

EPA is not proposing any changes to the Otto-cycle evaporative numerical emission standards in today's notice. However, the 1998 certification results show that, in general, heavy-duty Otto-cycle vehicles are meeting the current evaporative standards with a substantial safety margin. EPA is concerned that, in the absence of more stringent evaporative standards, manufacturers will reduce the safety margins they currently use in order to cut costs, resulting in rising evaporative emissions. The 1999 certification results appear to show this beginning to happen.

The California Air Resources Board recently proposed and adopted new evaporative emission standards applicable to all categories of Otto cycle vehicles and engines in the context of the LEV II standards discussed in the previous section. Those new evaporative standards call for dramatic reductions in the levels of emissions for both the three day diurnal plus hot soak and the supplemental two day diurnal plus hot soak measurements. In response to CARB's recent LEV II proposal, the vehicle manufacturers presented CARB with an alternate proposal for revised evaporative emission standards.[121] These proposed levels, while not as stringent as the standards CARB proposed and subsequently adopted, are significantly more stringent than the current federal standards. However, most 1998 model year HDVs were certified at levels below the manufacturers proposed standards, including comfortable safety margins. The current federal standards, CARB's new standards, and the manufacturers' proposed standards are all presented in the Table 25.

[121] A copy of the handouts presented to CARB on October 8, 1998 are in the docket for this rule.

TABLE 25.—''Existing Federal and CARB, and Manufacturer-Proposed Evaporative Emission Standards

	Three day diurnal plus hot soak (g/test)	Two day diurnal plus hot soak (g/test)
8,500 lbs <GVWR≤14,000 lbs:		
Current federal standards	3.0	3.5
New CARB standards	1.0	1.25
Manufacturer-proposed standards	1.5	1.7
GVWR ≤ 14,000 lbs:		
Current federal standards	4.0	4.5
New CARB standards [A]	1.0	1.25
Manufacturer-proposed standards [A]	1.5	2.25

[A] Note—These standards would be phased in as a % of sales at a rate of 25, 50, 75, and 100 percent beginning with the 2004 model year.

EPA requests comment whether more stringent evaporative emission standards for HDVs may be appropriate, especially considering the current certification levels. The Agency also requests comment on our belief that the manufacturer-proposed standards are feasible at little or no cost. EPA also requests comment on the feasibility and cost of other more stringent standards than those proposed by the manufacturers, including the standards recently adopted by CARB.

XI. What Are the Opportunities for Public Participation?

A. Comments and the Public Docket

EPA today opens a formal comment period for this NPRM and will accept comments through 30 days after the date of the public hearing. The Agency encourages all parties that have an interest in this proposal to offer comment on various topics. Of particular interest to the Agency are detailed comments in the following areas:

- The technical feasibility, cost-effectiveness, and appropriateness under the Clean Air Act of the 2004 $NMHC+NO_X$ emission standard for heavy-duty diesel engines.
- The feasibility of the 2004 $NMHC+NO_X$ standards with current diesel fuel, and the specific issue of full useful life durability and the impact of sulfuric acid formation on EGR systems.
- The technical feasibility, cost-effectiveness, and appropriateness under the Clean Air Act of the proposed 1.0 g/bhp-hr $NMHC+NO_X$ standard for heavy-duty Otto-cycle engines.
- The appropriateness and design of the proposed ABT program for heavy-duty Otto-cycle engines.
- The technical feasibility, cost-effectiveness, and appropriateness of the proposed supplemental tests and associated emission limits for diesel-cycle heavy-duty engines.
- The technical feasibility, cost-effectiveness, and appropriateness of the proposed chassis-based emission standards for Otto-cycle heavy-duty vehicles under 14,000 pounds GVWR.
- The proposed ABT program for Otto-cycle heavy-duty vehicles under 14,000 pounds GVWR.
- The technical feasibility, cost-effectiveness, and appropriateness of the proposed ORVR requirements for complete Otto-cycle heavy-duty vehicles under 10,000 pounds GVWR.
- The technical feasibility, cost-effectiveness, and appropriateness of the proposed OBD requirements for heavy-duty engines and vehicles at or below 14,000 lbs GVWR.
- Fuel neutrality of emission standards for diesel and Otto-cycle heavy-duty vehicles and engines.

Although the Agency specifically requests comments on the identified topics, the Agency welcomes comments on any aspect of the proposal. The most useful comments are those supported by appropriate and detailed rationales, data, and analyses. The Agency also encourages commenters that disagree with elements of the proposal to suggest and analyze alternate approaches to meeting the air quality goals of this proposal. All comments, with the exception of proprietary information, should be directed to the EPA Air Docket Section, Docket No. A–98–32 before the date specified above. Information related to this rulemaking is also found in dockets A–95–27 and A–97–10.

Commenters who wish to submit proprietary information for consideration should clearly separate such information from other comments by (1) labeling proprietary information ''Confidential Business Information'' and (2) sending proprietary information directly to the contact person listed (see FOR FURTHER INFORMATION CONTACT) and not to the public docket. This will help ensure that proprietary information is not inadvertently placed in the docket. If a commenter wants EPA to use a submission of confidential information as part of the basis for the final rule, then a non-confidential version of the document that summarizes the key data or information should be sent to the docket. Any information or data that constitutes, in whole or in part, a basis of EPA's regulatory actions will be made public.

Information covered by a claim of confidentiality will be disclosed by EPA only to the extent allowed and in accordance with the procedures set forth in 40 CFR part 2. If no claim of confidentiality accompanies the submission when it is received by EPA, it will be made available to the public without further notice to the commenter.

B. Public Hearing

The Agency will hold a public hearing as noted in the DATES section above. Any person desiring to present testimony at the public hearing is asked to notify the contact person listed above at least one week prior to the date of the hearing. This notification should include an estimate of the time required for the presentation of the testimony and any need for audio/visual equipment. EPA suggests that sufficient copies of the statement or material to be presented be available to the audience. In addition, it is helpful if the contact person receives a copy of the testimony or material prior to the hearing.

The hearing will be conducted informally, and technical rules of evidence will not apply. A sign-up sheet will be available at the hearing for scheduling the order of testimony. A written transcript of the hearing will be prepared. The official record of the hearing will be kept open for 30 days after the hearing to allow submittal of supplementary information.

XII. What Administrative Requirements Apply to This Proposal?

A. Compliance With Executive Order 12866

Under Executive Order 12866 (58 FR 51735), the Agency must determine whether this regulatory action is ''significant'' and therefore subject to review by the Office of Management and

Budget (OMB) and the requirements of the Executive Order. The Order defines a ''significant regulatory action'' as one that is likely to result in a rule that may:

(1) Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities;

(2) Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;

(3) Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or

(4) raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

Pursuant to the terms of Executive Order 12866, EPA has determined that this proposed rule is a ''significant regulatory action'' because the proposed regulatory provisions, if implemented, would have an annual effect on the economy in excess of $100 million. A Regulatory Impact Analysis has been prepared and is available in the docket associated with this rulemaking. This action was submitted to OMB for review as required by Executive Order 12866. Any written comments from OMB and any EPA response to OMB comments are in the public docket for this rule.

B. Impact on Small Entities

The Regulatory Flexibility Act (5 U.S.C. 601) requires federal agencies to consider potential impacts of federal regulations upon small entities. If a preliminary analysis indicates that a regulation would have a significant adverse economic impact on a substantial number of small entities, then EPA must prepare a regulatory flexibility analysis.

The Agency has determined that this action would not have a significant adverse impact on a substantial number of small entities, and thus it is not necessary to prepare a regulatory flexibility analysis in connection with this rule. Only two small entities are known to be affected by this rule. The entities are small businesses that certify alternative fuel engines or vehicles, either newly manufactured or modified from previously certified gasoline versions. EPA contacted these businesses and discussed the proposed rule with them, identifying their concerns. The concerns they expressed prompted revisions to the proposal, which are addressed elsewhere in the preamble. Rule revisions proposed by EPA are intended to minimize adverse impacts on the small entities affected by the proposed rule.

Therefore, as required under section 605 of the Regulatory Flexibility Act, 5 U.S.C. 601 *et. seq.*, as amended, I hereby certify that this regulation will not have a significant adverse impact on a substantial number of small entities.

C. Unfunded Mandates Reform Act

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA), Public Law 104–4, establishes requirements for Federal agencies to assess the effects of their regulatory actions on State, local, and tribal governments and the private sector. Under sections 202 and 205 of the UMRA, EPA generally must prepare a written statement to accompany any proposed and final rule that includes a federal mandate that may result in expenditures by state, local, and tribal governments in the aggregate, or by the private sector, of $100 million or more for any one year. Before promulgating an EPA rule for which a written statement is needed, section 205 of the UMRA generally requires EPA to identify and consider a reasonable number of regulatory alternatives and adopt the least costly, most cost effective, or least burdensome alternative that achieves the objectives of the rule. The provisions of section 205 do not apply when they are inconsistent with applicable law. Moreover, section 205 allows EPA to adopt an alternative other than the least costly, most cost effective, or least burdensome alternative if the Administrator publishes with the final rule an explanation of why that alternative was not adopted. Before EPA establishes any regulatory requirements that may significantly or uniquely affect small governments, including tribal governments, it must have developed under section 203 of the UMRA a small government agency plan. The plan must provide for notifying potentially affected small governments, enabling officials of affected small governments to have meaningful and timely input in the development of EPA regulatory proposals with significant federal intergovernmental mandates, and informing, educating, and advising small governments on compliance with the regulatory requirements.

Today's proposal contains no Federal mandates (under the regulatory provisions of Title II of the UMRA) for State, local, or tribal governments. The rule imposes no enforceable duties on any of these governmental entities. Nothing in the program would significantly or uniquely affect small governments. EPA has determined that this rule contains federal mandates that may result in expenditures of $100 million or more in any one year for the private sector.

As explained in section III.B of this preamble (''1999 Review of Heavy-duty Diesel Engine NMHC+NO_X Standards''), the 2004 heavy-duty diesel standards reaffirmed in this rulemaking were established in the Agency's 1997 final rulemaking for heavy-duty diesels, and the 1997 rulemaking laid the ground work for this proposal. Today's proposal for HD diesel engines is simply a review of the appropriateness under the Clean Air Act of the standard finalized in 1997, including the need for and technical and economic feasibility of the standard based on information available in 1999. Therefore, today's proposal does not contain any further analysis of other, alternative standards for heavy-duty diesel engines. The reader is directed to the rulemaking record for the 1997 rule, contained in EPA Air Docket A–95–27, for information on alternatives the Agency considered during that rulemaking.

Today's proposal includes an analysis of an alternative standard for HD Otto-cycle engines. Section VI.B of this preamble, and Chapter 3, Section III(H) of the draft RIA, contain a detailed description of the alternative standard proposed by the engine manufacturers. Section 202(a)(3) of the Clean Air Act requires that EPA must set emission standards for heavy-duty engines to reflect the greatest degree of emission reduction achievable through the application of technology which EPA determines will be available for the model year to which the standards apply, giving appropriate consideration to cost, energy, and safety factors associated with the application of such technology.

As indicated above, EPA believes the standards proposed reflect the greatest degree of emission reduction achievable by HD Otto-cycle engines in the 2004 model year and have a reasonable cost-effectiveness level. EPA is requesting comment on the proposed standard and alternatives. Based on comments received and information available at the time of the final rulemaking, EPA will make a final determination under § 202(a)(3) of the CAA. EPA will address the requirements of UMRA § 205 in connection with the final rule.

D. Reporting and Recordkeeping Requirements

The information collection requirements in this proposed rule have been submitted for approval to the Office of Management and Budget (OMB) under the Paperwork Reduction

Act, 44 U.S.C. 3501 *et seq.* An Information Collection Request (ICR) document has been prepared by EPA (ICR No. 2060–0104) and a copy may be obtained from Sandy Farmer by mail at OPPE Regulatory Information Division; U.S. Environmental Protection Agency (2137); 401 M St., S.W.; Washington, DC 20460, by email at farmer.sandy@epamail.epa.gov, or by calling (202) 260–2740. A copy may also be downloaded off the internet at http://www.epa.gov/icr. The following ICR document has been prepared by EPA:

EPA ICR #	Title
0783.38	Heavy Duty Engine Emission Certification.

The Agency proposes to collect information related to certification results. This information will be used to ensure compliance with and enforce the provisions in this rule. Responses will be mandatory in order to complete the certification process. Section 208(a) of the Clean Air Act requires that manufacturers provide information the Administrator may reasonably require to determine compliance with the regulations; submission of the information is therefore mandatory. EPA will consider confidential all information meeting the requirements of § 208(c) of the Clean Air Act.

This collection of information affects an estimated 66 respondents with a total of 459 responses per year and a total hour burden of 65,859 hours, for an estimated 143 hours per response, with estimated total annualized costs of $1,599,684 per year. The hours and annual cost of information collection activities by a given manufacturer depends on manufacturer-specific variables, such as the number of engine families, production changes, emissions defects, and so forth. Burden means the total time, effort, or financial resources expended by persons to generate, maintain, retain, or disclose or provide information to or for a Federal agency. This includes the time needed to review instructions; develop, acquire, install, and utilize technology and systems for the purposes of collecting, validating, and verifying information, processing and maintaining information, and disclosing and providing information; adjust the existing ways to comply with any previously applicable instructions and requirements; train personnel to be able to respond to a collection of information; search data sources; complete and review the collection of information; and transmit or otherwise disclose the information.

An Agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a currently valid OMB control number. The OMB control numbers for EPA's regulations are listed in 40 CFR Part 9 and 48 CFR Chapter 15.

Comments are requested on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques. Send comments on the ICR to the Director, OPPE Regulatory Information Division; U.S. Environmental Protection Agency (2137); 401 M St., S.W.; Washington, DC 20460; and to the Office of Information and Regulatory Affairs, Office of Management and Budget, 725 17th St., N.W., Washington, DC 20503, marked ''Attention: Desk Officer for EPA.'' Include the ICR number in any correspondence. Since OMB is required to make a decision concerning the ICR between 30 and 60 days after October 29, 1999, a comment to OMB is best assured of having its full effect if OMB receives it by November 29, 1999. The final rule will respond to any OMB or public comments on the information collection requirements contained in this proposal.

E. Compliance With Executive Order 13045

Executive Order 13045: ''Protection of Children from Environmental Health Risks and Safety Risks'' (62 FR 19885, April 23, 1997) applies to any rule that: (1) is determined to be ''economically significant'' as defined under Executive Order 12866, and (2) concerns an environmental health or safety risk that EPA has reason to believe may have a disproportionate effect on children. If the regulatory action meets both criteria, the Agency must evaluate the environmental health or safety effects of the planned rule on children, and explain why the planned regulation is preferable to other potentially effective and reasonably feasible alternatives considered by the Agency.

EPA interprets Executive Order 13045 as applying only to those regulatory actions that are based on health or safety risks, such that the analysis required under section 5–501 of the Order has the potential to influence the regulation. Today's proposal falls into that category only in part: risk considerations may be taken into account only to the extent the Agency may consider the inherent toxicity of a regulated pollutant, and any differential impacts such a pollutant may have on children's health, in deciding how to take cost and other relevant factors into consideration.

This rulemaking will achieve important reductions of various emissions from heavy-duty trucks, primarily emissions of NO_X. The rulemaking also addresses NMHC and PM. These pollutants raise concerns about a disproportionately greater effect on children's health, such as impacts from ozone, PM, and certain toxic air pollutants. See section II of this proposal and the RIA for a further discussion of these issues. The effects of ozone and PM on children's health was addressed in detail in EPA's rulemaking to establish these NAAQS, and EPA is not revisiting those issues here. EPA also believes the emissions reductions from the proposed strategies will reduce air toxics and the related impacts on children's health. EPA will be addressing the issues raised by air toxics from motor vehicles and their fuels in a separate rulemaking that EPA is initiating in the near future under section 202(l)(2) of the Act. That rulemaking will address the emissions of hazardous air pollutants from motor vehicles and fuels, and the appropriate level of control of hazardous air pollutants from these sources.

In this proposal EPA has evaluated several regulatory strategies for reductions in these emissions from heavy-duty engines. For the reasons described in this preamble, EPA believes that the strategies proposed are preferable under the Clean Air Act to other potentially effective and reasonably feasible alternatives considered by the Agency, for purposes of reducing emissions from these sources as a way of helping areas achieve and maintain the NAAQS for ozone and PM. Moreover, consistent with the Clean Air Act, the proposed levels of control are designed to achieve the greatest degree of reduction of emissions of these pollutants achievable through technology that will be available, taking cost and other factors into consideration.

F. Enhancing Intergovernmental Partnerships

Under Executive Order 12875, EPA may not issue a regulation that is not required by statute and that creates a mandate upon a State, local or tribal government, unless the Federal government provides the funds necessary to pay the direct compliance costs incurred by those governments, or EPA consults with those governments. If EPA complies by consulting, Executive Order 12875 requires EPA to provide to the Office of Management and Budget a description of the extent of EPA's prior consultation with representatives of affected State, local and tribal governments, the nature of their concerns, copies of any written communications from the governments, and a statement supporting the need to issue the regulation. In addition, Executive Order 12875 requires EPA to develop an effective process permitting elected officials and other representatives of State, local and tribal governments ''to provide meaningful and timely input in the development of regulatory proposals containing significant unfunded mandates.''

Today's rule does not create a mandate on State, local or tribal governments. The rule does not impose any enforceable duties on these entities. The rule will be implemented at the Federal level and imposes compliance obligations only on private industry. Accordingly, the requirements of section 1(a) of Executive Order 12875 do not apply to this rule.

G. Consultation and Coordination With Indian Tribal Governments

Under Executive Order 13084, EPA may not issue a regulation that is not required by statute, that significantly or uniquely affects the communities of Indian tribal governments, and that imposes substantial direct compliance costs on those communities, unless the Federal government provides the funds necessary to pay the direct compliance costs incurred by the tribal governments, or EPA consults with those governments. If EPA complies by consulting, Executive Order 13084 requires EPA to provide to the Office of Management and Budget, in a separately identified section of the preamble to the rule, a description of the extent of EPA's prior consultation with representatives of affected tribal governments, a summary of the nature of their concerns, and a statement supporting the need to issue the regulation. In addition, Executive Order 13084 requires EPA to develop an effective process permitting elected officials and other representatives of Indian tribal governments ''to provide meaningful and timely input in the development of regulatory policies on matters that significantly or uniquely affect their communities.''

Today's rule does not significantly or uniquely affect the communities of Indian tribal governments. The rule will be implemented at the Federal level and imposes compliance obligations only on private industry. Accordingly, the requirements of section 3(b) of Executive Order 13084 do not apply to this rule.

H. National Technology Transfer and Advancement Act

Section 12(d) of the National Technology Transfer and Advancement Act of 1995 (''NTTAA''), Public Law 104–113, section 12(d) (15 U.S.C. 272 note) directs EPA to use voluntary consensus standards in its regulatory activities unless doing so would be inconsistent with applicable law or would be otherwise impractical. Voluntary consensus standards are technical standards (e.g., materials specifications, test methods, sampling procedures, and business practices) that are developed or adopted by voluntary consensus standards bodies. NTTAA directs EPA to provide Congress, through OMB, explanations when the Agency decides not to use available and applicable voluntary consensus standards. This rule involves technical standards. The Agency is incorporating by reference applicable standards previously finalized by the Society of Automotive Engineers and the International Standards Organization. For a complete listing of the SAE and ISO standards incorporated by reference in this final rule, please see § 86.1, ''Reference Materials'' in the regulatory language immediately following this preamble.

I. Compliance With Executive Order on Federalism

On August 4, 1999, President Clinton issued a new executive order on federalism, Executive Order 13132, which will go into effect on November 2, 1999. In the interim, the current Executive Order 12612 on federalism is still applicable. Under this order, this rule does not have a substantial direct effect upon States, upon the relationship between the national government and the States, or upon the distribution of power and responsibilities among the various levels of government. This rule directly regulates manufacturers of heavy duty vehicles and engines, and does not impose any duties or obligations on, or restrict the powers of, any state.

XIII. What Is EPA's Statutory Authority for This Proposal?

Section 202(a)(3) authorizes EPA to establish emission standards for heavy duty vehicles and engines.[122] These standards are to reflect the greatest degree of emission reduction achievable through the application of technology which EPA determines will be available for the model year to which the standards apply. EPA is to give appropriate consideration to cost, energy, and safety factors associated with the application of such technology. Section 202(a)(3)(C) requires that promulgated standards apply for no less than three years and go into effect no less than 4 years after promulgation. Section 202(m) authorizes regulations requiring installation of on-board diagnostics systems for light-duty and heavy-duty vehicles and engines. Pursuant to sections 202(a)(1) and 202(d), these emission standards must be met throughout the entire useful life of the engine or vehicle as determined by EPA's regulations. If the Administrator determines that a substantial number of vehicles do not conform to emission standards when in actual use throughout their useful lives, section 207(c) of the Act requires EPA to make a determination of nonconformity. Section 208 of the Act requires manufacturers to perform tests (where not otherwise reasonably available), make reports and provide information the Administrator may reasonably require to determine whether the manufacturer is acting in compliance with the Act and regulations thereunder. The remainder of section 202, as well as sections 203, 206, 207, 208, and 301, provide additional authority for promulgation of these regulations.

[122] U.S.C. 7521(a)(3).

List of Subjects

40 CFR Part 85

Confidential business information, Imports, Incorporation by reference, Labeling, Motor vehicle pollution, Reporting and recordkeeping requirements, Research, Warranties.

40 CFR Part 86

Administrative practice and procedure, Confidential business information, incorporation by reference, Labeling, Motor vehicle pollution, Reporting and recordkeeping requirements.

Dated: October 6, 1999.

Carol M. Browner,

Administrator.

For the reasons set forth in the preamble, chapter I, title 40 of the Code of Federal Regulations is proposed to be amended as follows:

PART 85—CONTROL OF AIR POLLUTION FROM MOBILE SOURCES

1. The authority citation for part 85 is revised to read as follows:

Authority: 42 U.S.C. 7521, 7522, 7524, 7525, 7541, 7542, 7543, 7547, and 7601(a).

Subpart F—[Amended]

2. Section 85.501 is revised to read as follows:

§ 85.501 General applicability.

(a) Sections 85.502 through 85.505 are applicable to aftermarket conversion systems for which an enforcement exemption is sought from the tampering prohibitions contained in section 203 of the Act.

(b) References in this subpart to engine families and emission control systems shall be deemed to apply to durability groups and test groups as applicable for manufacturers certifying new light-duty vehicles, light-duty trucks, and Otto-cycle complete heavy-duty vehicles under the provisions of 40 CFR part 86, subpart S.

Subpart P—[Amended]

3. Section 85.1501 is amended by revising paragraph (c), to read as follows:

§ 85.1501 Applicability.

* * * * *

(c) References in this subpart to engine families and emission control systems shall be deemed to apply to durability groups and test groups as applicable for manufacturers certifying new light-duty vehicles, light-duty trucks, and Otto-cycle complete heavy-duty vehicles under the provisions of 40 CFR part 86, subpart S.

Subpart R—[Amended]

4. Section 85.1701 is amended by revising paragraph (c), to read as follows:

§ 85.1701 General applicability.

* * * * *

(c) References in this subpart to engine families and emission control systems shall be deemed to apply to durability groups and test groups as applicable for manufacturers certifying new light-duty vehicles, light-duty trucks, and Otto-cycle complete heavy-duty vehicles under the provisions of 40 CFR part 86, subpart S.

PART 86—CONTROL OF EMISSIONS FROM NEW AND IN-USE HIGHWAY VEHICLES AND ENGINES

5. The authority citation for part 86 continues to read as follows:

Authority: 42 U.S.C. 7401–7671q.

6. Section 86.1 is amended by adding an entry to the table in alphanumeric order in paragraphs (b)(2) and (b)(5), to read as follows:

§ 86.1 Reference materials.

* * * * *

(b) * * *

(2) * * *

Document No. and name	40 CFR part 86 reference
* * * * * *	*
SAE J1939, Recommended Practice for a Serial Control and Communications Vehicle Network	86.004–17; 86.1806–04

* * * * *

(5) * * *

Document No. and name	40 CFR part 86 reference
* * * * * *	*
ISO 14230–4 April 1996, Road Vehicles—Diagnostic systems—KWP 2000 requirements for Emission-related systems.	86.004–17; 86.1806–04

Subpart A—[Amended]

7. A new § 86.000–15 is added to subpart A to read as follows:

§ 86.000–15 NO_X and particulate averaging, trading, and banking for heavy-duty engines.

Section 86.000–15 includes text that specifies requirements that differ from § 86.094–15 or § 86.098–15. Where a paragraph in § 86.094–15 or § 86.098–15 is identical and applicable to § 86.000–15, this may be indicated by specifying the corresponding paragraph and the statement ''[Reserved]. For guidance see § 86.094–15.'' or ''[Reserved]. For guidance see § 86.098–15.''.

(a) through (b) [Reserved] For guidance see § 86.094–15.

(c) [Reserved] For guidance see § 86.098–15.

(d) through (i) [Reserved] For guidance see § 86.094–15.

(j) *Optional program for early banking for diesel engines.* Provisions set forth in §§ 86.094–15 (a), (b), (d) through (i), and 86.098–15 (c) apply except as specifically stated otherwise in § 86.098–15 (j)(1) through (j)(3)(iii).

(j)(1) through (j)(3)(iii) [Reserved] For guidance see § 86.098–15.

(k) *Optional program for early banking for Otto-cycle engines.* Provisions set forth in §§ 86.094–15(a), (b), (d) through (i), and 86.098–15(c) apply except as specifically stated otherwise in this paragraph (k).

(1) To be eligible for the optional program described in this paragraph (k), the following must apply:

(i) Credits are generated from Otto-cycle heavy-duty engines.

(ii) During certification, the manufacturer shall declare its intent to include specific engine families in the program described in this paragraph. Separate declarations are required for each program and no engine families may be included in both programs in the same model year.

(2) *Credit generation and use.* (i) Credits shall only be generated by 2000 and later model year engine families.

(ii) Credits may only be used for 2004 and later model year heavy-duty Otto-cycle engines. When used with 2004 and later model year engines, NO_x credits may be used to meet the NO_x plus NMHC standard, except as otherwise provided in § 86.004–11(a)(1)(i)(D).

(iii) If a manufacturer chooses to use credits generated under this paragraph (k) prior to model year 2004, the averaging, trading, and banking of such credits shall be governed by the program provided in §§ 86.094–15(a), (b), (d) through (i) and 86.098–15(c) and shall be subject to all discounting, credit life limits and all other provisions contained therein. In the case where the manufacturer can demonstrate that the credits were discounted under the program provided in this paragraph (k), that discount may be accounted for in the calculation of credits described in § 86.098–15(c).

(3) *Program flexibilities.* (i) NO_X credits that are banked until model year 2004 under this paragraph (k) may be used in 2004 or any model year thereafter without being forfeited due to credit age. The requirement in this paragraph (k)(3) applies instead of the requirements in § 86.094–15(f)(2)(i).

(ii) There are no regional category restraints for averaging, trading, and banking of credits generated under the program described in this paragraph (k). This applies instead of the regional category provisions described in the introductory text of § 86.094–15 (d) and (e).

(iii) *Credit discounting.* (A) For NO_X credits generated under this paragraph (k) from engine families with NO_X FELs greater than 1.0 grams per brake horsepower-hour for oxides of nitrogen, a Discount value of 0.9 shall be used instead of 0.8 in the credit availability equation in § 86.098–15(c)(1).

(B) For NO_X credits generated under this paragraph (k) from engine families with NO_X FELs less than or equal to 1.0 grams per brake horsepower-hour for oxides of nitrogen, a Discount value of 1.0 shall be used in place of 0.8 in the credit availability equation in § 86.098–15 (c)(1).

(iv) *Credit calculation.* For NO_X credits generated under this paragraph (k), a Std value of 2.0 grams per brake horsepower-hour shall be used in place of the current and applicable NO_X standard in the credit availability equation in § 86.098–15(c)(1).

(l) *Credit apportionment.* At the manufacturer's option, credits generated under the provisions described in this section may be sold to or otherwise provided to another party for use in programs other than the averaging, trading and banking program described in this section.

(1) The manufacturer shall pre-identify two emission levels per engine family for the purposes of credit apportionment. One emission level shall be the FEL and the other shall be the level of the standard that the engine family is required to certify to under § 86.098–10 or § 86.098–11, as applicable. For each engine family, the manufacturer may report engine sales in two categories, ''ABT-only credits'' and ''non-manufacturer-owned credits''.

(i) For engine sales reported as ''ABT-only credits'', the credits generated must be used solely in the ABT program described in this section.

(ii) The engine manufacturer may declare a portion of engine sales ''non-manufacturer-owned credits'' and this portion of the credits generated between the standard and the FEL, based on the calculation in § 86.098–15(c)(1), would belong to another party. For ABT, the manufacturer may not generate any credits for the engine sales reported as ''nonmanufacturer-owned credits''. Engines reported as ''non-manufacturer-owned credits'' shall comply with the FEL and the requirements of the ABT program in all other respects.

(2) Only manufacturer-owned credits reported as ''ABT-only credits'' shall be used in the averaging, trading, and banking provisions described in this section.

(3) Credits shall not be double-counted. Credits used in the ABT program may not be provided to an engine purchaser for use in another program.

(4) Manufacturers shall determine and state the number of engines sold as ''ABT-only credits'' and ''non-manufacturer-owned credits'' in the end-of-model year reports required under § 86.098–23.

8. Section 86.000–16 is amended by removing paragraphs (a) through (d) introductory text, adding paragraphs (a), (b), (c), and (d) introductory text, and revising paragraph (d)(1), to read as follows:

§ 86.000–16 Prohibition of defeat devices.

* * * * *

(a) No new light-duty vehicle, light-duty truck, heavy-duty vehicle, or heavy-duty engine shall be equipped with a defeat device.

(b) The Administrator may test or require testing on any vehicle or engine at a designated location, using driving cycles and conditions which may reasonably be expected to be encountered in normal operation and use, for the purpose of investigating a potential defeat device.

(c) [Reserved]. For guidance see § 86.094–16.

(d) For vehicle and engine designs designated by the Administrator to be investigated for possible defeat devices:

(1) The manufacturer must show to the satisfaction of the Administrator that the vehicle or engine design does not incorporate strategies that unnecessarily reduce emission control effectiveness exhibited during the Federal emissions test procedure when the vehicle or engine is operated under conditions which may reasonably be expected to be encountered in normal operation and use.

* * * * *

9. Section 86.001–1 is amended by revising paragraph (b) to read as follows:

§ 86.001–1 General applicability.

* * * * *

(b) *Optional applicability.* (1) A manufacturer may request to certify any heavy-duty vehicle of 14,000 pounds Gross Vehicle Weight Rating or less in accordance with the light-duty truck provisions located in subpart S of this part through the 2003 model year. Heavy-duty engine or vehicle provisions of this subpart A do not apply to such a vehicle.

(2) Beginning with the 2001 model year, a manufacturer may certify any Otto-cycle heavy-duty vehicle of 14,000 pounds Gross Vehicle Weight Rating or less in accordance with the provisions for complete Otto-cycle heavy-duty vehicles located in subpart S of this part for purposes of generating credits in the heavy-duty vehicle averaging, banking, and trading program contained in § 86.1817–04. Heavy-duty engine or heavy-duty vehicle provisions of this subpart A do not apply to such a vehicle.

* * * * *

10. A new § 86.004–1 is added to subpart A to read as follows:

§ 86.004–1 General applicability.

Section 86.004–1 includes text that specifies requirements that differ from § 86.001–1. Where a paragraph in § 86.001–1 is identical and applicable to § 86.004–1, this may be indicated by specifying the corresponding paragraph and the statement ''[Reserved]. For guidance see § 86.001–1.''.

(a) The provisions of this subpart generally apply to 2004 and later model year new Otto-cycle heavy-duty engines used in incomplete vehicles and vehicles above 14,000 pounds GVWR and new diesel-cycle heavy-duty engines. In cases where a provision applies only to a certain vehicle group based on its model year, vehicle class, motor fuel, engine type, or other distinguishing characteristics, the limited applicability is cited in the appropriate section or paragraph. The provisions of this subpart continue to generally apply to 2000 and earlier model year new Otto-cycle and diesel-cycle light-duty vehicles, 2000 and earlier model year new Otto-cycle and diesel-cycle light-duty trucks, and 2003 and earlier model year new Otto-cycle complete heavy-duty vehicles at or below 14,000 pounds GVWR. Provisions generally applicable to 2001 and later model year new Otto-cycle and diesel-cycle light-duty vehicles, 2001 and later model year new Otto-cycle and diesel-cycle light-duty trucks, and 2004 and later model year Otto-cycle complete heavy-duty vehicles at or below 14,000 pounds GVWR are located in subpart S of this part.

(b) *Optional applicability.* For 2004 and later model years, a manufacturer may request to certify any incomplete heavy-duty vehicle of 14,000 pounds Gross Vehicle Weight Rating or less in accordance with the provisions for complete heavy-duty vehicles located in subpart S of this part. Heavy-duty engine or heavy-duty vehicle provisions of this subpart A do not apply to such a vehicle.

(c) [Reserved]

(d) [Reserved]

(e) through (f) [Reserved]. For guidance see § 86.001–1.

11. Section 86.004–2 is amended by adding definitions in alphabetical order for ''defeat device,'' ''heavy-duty vehicle,'' and ''light-duty truck'' to read as follows:

§ 86.004–2 Definitions.

* * * * *

Defeat device means an auxiliary emission control device (AECD) that reduces the effectiveness of the emission control system under conditions which may reasonably be expected to be encountered in normal vehicle operation and use, unless:

(1) Such conditions are substantially included in the applicable Federal emission test procedure for heavy-duty vehicles and heavy-duty engines described in subpart N of this part, excluding the test procedure referred to as the ''Not-To-Exceed Test Procedure'' contained in § 86.1370, and excluding the Maximum Allowable Emission Limits contained in § 86.1370(f);

(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.

Heavy-duty vehicle means any motor vehicle rated at more than 8,500 pounds GVWR or that has a vehicle curb weight of more than 6,000 pounds or that has a basic vehicle frontal area in excess of 45 square feet, excluding vehicles with a GVWR greater than 8,500 pounds and less than or equal to 10,000 pounds that are defined as light-duty trucks.

Light-duty truck means: (1) Any motor vehicle rated at 8,500 pounds GVWR or less which has a curb weight of 6,000 pounds or less and which has a basic vehicle frontal area of 45 square feet or less, which is:

(i) Designed primarily for purposes of transportation of property or is a derivation of such a vehicle; or

(ii) Designed primarily for transportation of persons and has a capacity of more than 12 persons; or

(iii) Available with special features enabling off-street or off-highway operation and use; or

(2) Any motor vehicle rated at greater than 8,500 pounds GVWR and less than or equal to 10,000 pounds GVWR which is a complete vehicle designed primarily for transportation of persons and has a capacity of not more than 12 persons.

* * * * *

12. A new § 86.004–10 is added to subpart A to read as follows:

§ 86.004–10 Emission standards for 2004 and later model year Otto-cycle heavy-duty engines and vehicles.

Section 86.004–10 includes text that specifies requirements that differ from § 86.099–10. Where a paragraph in § 86.099–10 is identical and applicable to § 86.004–10, this may be indicated by specifying the corresponding paragraph and the statement ''[Reserved]. For guidance see § 86.099–10.''.

(a)(1) Exhaust emissions from new 2004 and later model year Otto-cycle HDEs shall not exceed:

(i)(A) *Oxides of Nitrogen plus Non-methane Hydrocarbons (NO_X* + NMHC) for engines fueled with either gasoline, natural gas, or liquefied petroleum gas. 1.0 grams per brake horsepower-hour (0.37 gram per megajoule), as measured under transient operating conditions.

(B) *Oxides of Nitrogen plus Non-methane Hydrocarbon Equivalent (NO_X* + NMHCE) for engines fueled with methanol. 1.0 grams per brake horsepower-hour (0.37 gram per megajoule), as measured under transient operating conditions.

(C) A manufacturer may elect to include any or all of its Otto-cycle HDE families in any or all of the emissions ABT programs for HDEs, within the restrictions described in § 86.098–15. If the manufacturer elects to include engine families in any of these programs, the NO_X plus NMHC (or NO_X plus NMHCE for methanol-fueled engines) FELs may not exceed 4.5 grams per brake horsepower-hour (1.7 grams per megajoule). This ceiling value applies whether credits for the family are derived from averaging, banking, or trading programs.

(ii)(A) *Carbon monoxide for engines intended for use in all vehicles, except as provided in paragraph (a)(1)(ii)(B) of this section.* 14.4 grams per brake horsepower-hour (5.36 grams per megajoule), as measured under transient operating conditions.

(B) *Carbon monoxide for engines intended for use only in vehicles with a Gross Vehicle Weight Rating of greater than 14,000 pounds.* 37.1 grams per brake horsepower-hour (13.8 grams per megajoule), as measured under transient operating conditions.

(C) *Idle carbon monoxide. For all Otto-cycle HDEs utilizing aftertreatment technology: 0.50 percent of exhaust gas flow at curb idle.*

(2) The standards set forth in paragraph (a)(1) of this section refer to the exhaust emitted over the operating schedule set forth in paragraph (f)(1) of appendix I to this part, and measured and calculated in accordance with the procedures set forth in subpart N or P of this part.

(3)(i) A manufacturer may certify one or more Otto-cycle HDE configurations intended for use in all vehicles to the emission standard set forth in paragraphs (a)(1)(ii)(B) of this section: Provided, that the total model year sales of such configuration(s), segregated by fuel type, being certified to the emission standard in paragraph (a)(1)(ii)(B) of this section represent no more than five percent of total model year sales of each fuel type Otto-cycle HDE intended for use in vehicles with a Gross Vehicle Weight Rating of up to 14,000 pounds by the manufacturer.

(ii) The configurations certified to the emission standards of paragraphs (a)(1)(ii)(B) of this section under the provisions of paragraph (a)(3)(i) of this section shall still be required to meet the evaporative emission standards set forth in § 86.099–10(b)(1)(i), (b)(2)(i) and (b)(3)(i).

(4) [Reserved]

(b) [Reserved]. For guidance see § 86.099–10.

(c) No crankcase emissions shall be discharged into the ambient atmosphere from any new 1998 or later model year Otto-cycle HDE.

(d) Every manufacturer of new motor vehicle engines subject to the standards prescribed in this section shall, prior to taking any of the actions specified in section 203(a)(1) of the Act, test or cause to be tested motor vehicle engines in accordance with applicable procedures in subpart N or P of this part to ascertain that such test engines meet the requirements of this section.

13. Section 86.004–11 is amended by adding paragraphs (a)(3) and (a)(4) and (b)(1)(iv), and by revising paragraph (b)(2), to read as follows:

§ 86.004–11 Emission standards for 2004 and later model year diesel heavy-duty engines and vehicles.

(a) * * *

(3)(i) The weighted average exhaust emissions, as determined under § 86.1360–2004(e)(5) pertaining to the supplemental steady-state test cycle, for each regulated pollutant shall not exceed 1.0 times the applicable emission standards or FELs specified in paragraph (a)(1) of this section.

(ii) Exhaust emissions shall not exceed the Maximum Allowable Emission Limits (for the corresponding speed and load), as determined under § 86.1360–2004(f), when the engine is operated in the steady-state control area defined under § 86.1360–2004(d).

(4)(i) The weighted average emissions, as determined under § 86.1370 pertaining to the not-to-exceed test procedures, for each regulated pollutant shall not exceed 1.25 times the applicable emission standards or FELs specified in paragraph (a)(1) of this section, except as noted in paragraph (a)(4)(ii) of this section.

Exhaust emissions shall not exceed either the Maximum Allowable Emission Limits (for the corresponding speed and load), as determined under § 86.1360(f) or the exhaust emissions specified in paragraph (a)(4)(i) of this section, whichever is numerically lower, when the engine is operated in the steady-state control area defined under § 86.1360(d).

(b) * * *

(1) * * *

(iv) A filter smoke number of 1.0, or the following alternate opacity limits:

(A) A 30 second transient test average opacity limit of 4% for a 5 inch path; and

(B) A 10 second steady state test average opacity limit of 4% for a 5 inch path.

(2)(i) The standards set forth in paragraphs (b)(1)(i) through (iii) of this section refer to exhaust smoke emissions generated under the conditions set forth in subpart I of this part and measured and calculated in accordance with those procedures.

(ii) The standards set forth in paragraph (b)(1)(iv) of this section refer to exhaust smoke emissions generated under the conditions set forth in § 86.1380 and calculated in accordance with the procedures set forth in § 86.1372.

* * * * *

14. Section 86.004–15 is amended by revising the section heading and paragraphs (a)(1), (b) introductory text, (b)(1)(i), (b)(1)(ii), (c)(1) introductory text, (c)(1)(iii), (d) introductory text, (d)(1)(i), (d)(1)(ii), (f) heading, (f)(1)(i), (f)(2)(i), (f)(2)(ii), (f)(3)(ii), (f)(3)(iii), (g)(1), (g)(2) introductory text, (g)(2)(i), (g)(2)(ii), (g)(4), (j) introductory text, (j)(1) introductory text, (k) heading and introductory text, removing paragraphs (a)(2)(iii) and (d)(1)(iii), and adding paragraph (l), to read as follows:

§ 86.004–15 NO_X plus NMHC and particulate averaging, trading, and banking for heavy-duty engines.

(a)(1) Heavy-duty engines eligible for NO_X plus NMHC and particulate averaging, trading and banking programs are described in the applicable emission sandards sections in this subpart. All heavy-duty engine families which include any engines labeled for use in clean-fuel vehicles as specified in 40 CFR part 88 are not eligible for these programs. Participation in these programs is voluntary.

* * * * *

(b) Participation in the NO_X plus NMHC and/or particulate averaging, trading, and banking programs shall be done as follows:

(1) * * *

(i) Declare its intent to include specific engine families in the averaging, trading and/or banking programs. Separate declarations are required for each program and for each pollutant (i.e., NO_X plus NMHC, and particulate).

(ii) Declare an FEL for each engine family participating in one or more of these two programs.

(A) The FEL must be to the same level of significant digits as the emission standard (one-tenth of a gram per brake horsepower-hour for NO_X plus NMHC emissions and one-hundredth of a gram per brake horsepower-hour for particulate emissions).

(B) In no case may the FEL exceed the upper limit prescribed in the section concerning the applicable heavy-duty engine NO_X plus NMHC and particulate emission standards.

* * * * *

(c)(1) For each participating engine family, NO_X plus NMHC, and particulate emission credits (positive or negative) are to be calculated according to one of the following equations and rounded, in accordance with ASTM E29–93a, to the nearest one-tenth of a Megagram (Mg). Consistent units are to be used throughout the equation.

* * * * *

(iii) For purposes of the equation in paragraphs (c)(1)(i) and (ii) of this section:

Std = the current and applicable heavy-duty engine NO_X plus NMHC or particulate emission standard in grams per brake horsepower hour or grams per Megajoule.

FEL = the NO_X plus NMHC, or particulate family emission limit for the engine family in grams per brake horsepower hour or grams per Megajoule.

CF = a transient cycle conversion factor in BHP-hr/mi or MJ/mi, as given in paragraph (c)(2) of this section.

UL = the useful life described in § 86.004–2, or alternative life as described in § 86.004–21(f), for the given engine family in miles.

Production = the number of engines produced for U.S. sales within the given engine family during the model year. Quarterly production projections are used for initial certification. Actual production is used for end-of-year compliance determination.

Discount = a one-time discount applied to all credits to be banked or traded within the model year generated. Except as otherwise allowed in paragraphs (k) and (l) of this section, the discount applied here is 0.9. Banked credits traded in a subsequent model year will not be subject to an additional discount. Banked credits used in a subsequent model year's averaging program will not have the discount restored.

* * * * *

(d) *Averaging sets for NO_X plus NMHC emission credits.* The averaging and trading of NO_X plus NMHC emission credits will only be allowed between heavy-duty engine families in the same averaging set. The averaging sets for the averaging and trading of NO_X plus NMHC emission credits for heavy-duty engines are defined as follows:

(1) For NO_X+NMHC credits from Otto-cycle heavy-duty engines:

(i) Otto-cycle heavy-duty engines constitute an averaging set. Averaging and trading among all Otto-cycle heavy-duty engine families is allowed. There are no subclass restrictions.

(ii) Otto-cycle heavy-duty vehicles certified under the chassis-based provisions of Subpart S of this Part may not average or trade with heavy-duty Otto-cycle engines.

* * * * *

(f) *Banking of NO_X plus NMHC, and particulate emission credits.* (1) * * * (i) NO_X plus NMHC, and particulate emission credits may be banked from engine families produced in any model year.

* * * * *

(2) * * * (i) NO_X plus NMHC and particulate credits generated in 2004 and later model years do not expire.

(ii) Manufacturers withdrawing banked NO_X plus NMHC, and/or particulate credits shall indicate so during certification and in their credit reports, as described in § 86.091–23.

(3) * * *

(ii) Banked credits may not be used for NO_X plus NMHC or particulate averaging and trading to offset emissions that exceed an FEL. Banked credits may not be used to remedy an in-use nonconformity determined by a Selective Enforcement Audit or by recall testing. However, banked credits may be used for subsequent production of the engine family if the manufacturer elects to recertify to a higher FEL.

(iii) Banked NO_X credits from 2003 and earlier model years may be used in place of NO_X plus NMHC credits after 2003 provided that they are used in the correct averaging set and the NO_X credits have not expired.

(g)(1) This paragraph (g) assumes NO_X plus NMHC, and particulate nonconformance penalties (NCPs) will be available for the 2004 and later model year HDEs.

(2) Engine families using NO_X plus NMHC and/or particulate NCPs but not involved in averaging:

(i) May not generate NO_X plus NMHC or particulate credits for banking and trading.

(ii) May not use NO_X plus NMHC or particulate credits from banking and trading.

* * * * *

(4) If a manufacturer has any engine family in a given averaging set which is using NO_X plus NMHC and/or particulate NCPs, none of that manufacturer's engine families in that averaging set may generate credits for banking and trading.

* * * * *

(j) *Credit apportionment.* At the manufacturer's option, credits generated under the provisions described in this section may be sold to or otherwise provided to another party for use in programs other than the averaging, trading and banking program described in this section.

(1) The manufacturer shall pre-identify two emission levels per engine family for the purposes of credit apportionment. One emission level shall be the FEL and the other shall be the level of the standard that the engine family is required to certify to under § 86.004–10 or § 86.004–11. For each engine family, the manufacturer may report engine sales in two categories, ''ABT-only credits'' and ''nonmanufacturer-owned credits'.

* * * * *

(k) *Additional flexibility for diesel-cycle engines.* If a diesel-cycle engine family meets the conditions of either paragraph (k)(1) or (2) of this section, a Discount of 1.0 may be used in the trading and banking calculation, for both NO_X plus NMHC and for particulate, described in paragraph (c)(1) of this section.

* * * * *

(l) *Additional flexibility for Otto-cycle engines.* If an Otto-cycle engine family meets the conditions of paragraph (l)(1) or (2) of this section, a discount of 1.0 may be used in the trading and banking credits calculation for NO_X plus NMHC described in paragraph (c)(1) of this section.

(1) The engine family has a FEL of 0.5 g/bhp-hr NO_X plus NMHC or lower;

(2) All of the following conditions are met:

(i) For model years 2004, 2005, and 2006 only;

(ii) An engine family is certified using carry-over certification data from a 2003 or earlier model year where the sum of the NO_X FEL plus the HC (or hydrocarbon equivalent where applicable) certification level is below 1.0 g/bhp-hr.

15. Section 86.004–16 is added to subpart A to read as follows:

§ 86.004–16 Prohibition of defeat devices.

(a) No new heavy-duty vehicle or heavy-duty engine shall be equipped with a defeat device.

(b) The Administrator may test or require testing on any vehicle or engine at a designated location, using driving cycles and conditions which may reasonably be expected to be encountered in normal operation and use, for the purpose of investigating a potential defeat device.

(c) [Reserved]

(d) For vehicle and engine designs designated by the Administrator to be investigated for possible defeat devices:

(1) *General.* The manufacturer must show to the satisfaction of the Administrator that the vehicle or engine design does not incorporate strategies that unnecessarily reduce emission control effectiveness exhibited during the Federal emissions test procedures, described in subpart N of this part, excluding the test procedure referred to as the ''Not-To-Exceed Test Procedure'' contained in § 86.1370, and the Maximum Allowable Emission Limits contained in § 86.1360(f), when the vehicle or engine is operated under conditions which may reasonably be expected to be encountered in normal operation and use.

(2) *Information submissions required.* The manufacturer will provide an explanation containing detailed information (including information which the Administrator may request to be submitted) regarding test programs, engineering evaluations, design specifications, calibrations, on-board computer algorithms, and design strategies incorporated for operation both during and outside of the Federal emission test procedure described in subpart N of this part, excluding the test procedure referred to as the ''Not-To-Exceed Test Procedure'' contained in § 86.1370.

16. Section 86.004–17 is added to subpart A, to read as follows:

§ 86.004–17 On-board diagnostics.

(a) *General.* All heavy-duty engines intended for use in a heavy-duty vehicle weighing 14,000 pounds GVWR or less must be equipped with an on-board diagnostic (OBD) system capable of monitoring all emission-related engine systems or components during the applicable useful life. Heavy-duty engines intended for use in a heavy-duty vehicle weighing 14,000 pounds GVWR or less must meet the OBD requirements of this section according to the phase-in schedule in paragraph (k) of this section. All monitored systems and components must be evaluated periodically, but no less frequently than once per applicable certification test cycle as defined in Appendix I, paragraph (f), of this part, or similar trip as approved by the Administrator.

(b) *Malfunction descriptions.* The OBD system must detect and identify malfunctions in all monitored emission-related engine systems or components according to the following malfunction definitions as measured and calculated in accordance with test procedures set forth in subpart N of this part (engine-based test procedures) excluding the test procedure referred to as the ''Not-To-Exceed Test Procedure'' contained in § 86.1370, and excluding the test procedure referred to as the ''Load Response Test'' contained in § 86.1380.

(1) *Catalysts and particulate traps. (i) Otto-cycle.* Catalyst deterioration or malfunction before it results in an increase in NMHC emissions 1.5 times the NMHC+NO_X standard or FEL, as compared to the NMHC+NO_X emission level measured using a representative 4000 mile catalyst system.

(ii) *Diesel.* If equipped, catalyst or particulate trap deterioration or malfunction before it results in exhaust emissions exceeding 1.5 times the applicable standard or FEL for NMHC+NO_X or PM. This monitoring need not be done if the manufacturer can demonstrate that deterioration or malfunction of the system will not result in exceedance of the threshold; however, the presence of the catalyst or particulate trap must still be monitored.

(2) *Engine Misfire.* (i) *Otto-cycle.* Engine misfire resulting in exhaust emissions exceeding 1.5 times the applicable standard or FEL for NMHC+NO_X or CO; and any misfire capable of damaging the catalytic converter.

(ii) *Diesel.* Lack of cylinder combustion must be detected.

(3) *Oxygen sensors.* If equipped, oxygen sensor deterioration or malfunction resulting in exhaust emissions exceeding 1.5 times the applicable standard or FEL for $NMHC+NO_X$ or CO.

(4) *Evaporative leaks.* If equipped, any vapor leak in the evaporative and/or refueling system (excluding the tubing and connections between the purge valve and the intake manifold) greater than or equal in magnitude to a leak caused by a 0.040 inch diameter orifice; an absence of evaporative purge air flow from the complete evaporative emission control system. Where fuel tank capacity is greater than 25 gallons, the Administrator may, following a request from the manufacturer, revise the size of the orifice to the smallest orifice feasible, based on test data, if the most reliable monitoring method available cannot reliably detect a system leak equal to a 0.040 inch diameter orifice.

(5) *Other emission control systems.* Any deterioration or malfunction occurring in an engine system or component directly intended to control emissions, including but not necessarily limited to, the exhaust gas recirculation (EGR) system, if equipped, the secondary air system, if equipped, and the fuel control system, singularly resulting in exhaust emissions exceeding 1.5 times the applicable emission standard or FEL for $NMHC+NO_X$, CO or diesel PM. For engines equipped with a secondary air system, a functional check, as described in paragraph (b)(6) of this section, may satisfy the requirements of this paragraph (b)(5) provided the manufacturer can demonstrate that deterioration of the flow distribution system is unlikely. This demonstration is subject to Administrator approval and, if the demonstration and associated functional check are approved, the diagnostic system must indicate a malfunction when some degree of secondary airflow is not detectable in the exhaust system during the check. For engines equipped with positive crankcase ventilation (PCV), monitoring of the PCV system is not necessary provided the manufacturer can demonstrate to the Administrator's satisfaction that the PCV system is unlikely to fail.

(6) *Other emission-related engine components.* Any other deterioration or malfunction occurring in an electronic emission-related engine system or component not otherwise described above that either provides input to or receives commands from the on-board computer and has a measurable impact on emissions; monitoring of components required by this paragraph (b)(6) must be satisfied by employing electrical circuit continuity checks and rationality checks for computer input components (input values within manufacturer specified ranges based on other available operating parameters), and functionality checks for computer output components (proper functional response to computer commands) except that the Administrator may waive such a rationality or functionality check where the manufacturer has demonstrated infeasibility. Malfunctions are defined as a failure of the system or component to meet the electrical circuit continuity checks or the rationality or functionality checks.

(7) *Performance of OBD functions.* Oxygen sensor or any other component deterioration or malfunction which renders that sensor or component incapable of performing its function as part of the OBD system must be detected and identified on vehicles so equipped.

(c) *Malfunction indicator light (MIL).* The OBD system must incorporate a malfunction indicator light (MIL) readily visible to the vehicle operator. When illuminated, the MIL must display ''Check Engine,'' ''Service Engine Soon,'' a universally recognizable engine symbol, or a similar phrase or symbol approved by the Administrator. More than one general purpose malfunction indicator light for emission-related problems should not be used; separate specific purpose warning lights (*e.g.* brake system, fasten seat belt, oil pressure, etc.) are permitted. The use of red for the OBD-related malfunction indicator light is prohibited.

(d) *MIL illumination.* The MIL must illuminate and remain illuminated when any of the conditions specified in paragraph (b) of this section are detected and verified, or whenever the engine control enters a default or secondary mode of operation considered abnormal for the given engine operating conditions. The MIL must blink once per second under any period of operation during which engine misfire is occurring and catalyst damage is imminent. If such misfire is detected again during the following driving cycle (*i.e.*, operation consisting of, at a minimum, engine start-up and engine shut-off) or the next driving cycle in which similar conditions are encountered, the MIL must maintain a steady illumination when the misfire is not occurring and then remain illuminated until the MIL extinguishing criteria of this section are satisfied. The MIL must also illuminate when the vehicle's ignition is in the ''key-on'' position before engine starting or cranking and extinguish after engine starting if no malfunction has previously been detected. If a fuel system or engine misfire malfunction has previously been detected, the MIL may be extinguished if the malfunction does not reoccur during three subsequent sequential trips during which similar conditions are encountered and no new malfunctions have been detected. Similar conditions are defined as engine speed within 375 rpm, engine load within 20 percent, and engine warm-up status equivalent to that under which the malfunction was first detected. If any malfunction other than a fuel system or engine misfire malfunction has been detected, the MIL may be extinguished if the malfunction does not reoccur during three subsequent sequential trips during which the monitoring system responsible for illuminating the MIL functions without detecting the malfunction, and no new malfunctions have been detected. Upon Administrator approval, statistical MIL illumination protocols may be employed, provided they result in comparable timeliness in detecting a malfunction and evaluating system performance, *i.e.*, three to six driving cycles would be considered acceptable.

(e) *Storing of Computer Codes.* The OBD system shall record and store in computer memory diagnostic trouble codes and diagnostic readiness codes indicating the status of the emission control system. These codes shall be available through the standardized data link connector per specifications as referenced in paragraph (h) of this section.

(1) A diagnostic trouble code must be stored for any detected and verified malfunction causing MIL illumination. The stored diagnostic trouble code must identify the malfunctioning system or component as uniquely as possible. At the manufacturer's discretion, a diagnostic trouble code may be stored for conditions not causing MIL illumination. Regardless, a separate code should be stored indicating the expected MIL illumination status (*i.e.*, MIL commanded ''ON,'' MIL commanded ''OFF'').

(2) For a single misfiring cylinder, the diagnostic trouble code(s) must uniquely identify the cylinder, unless the manufacturer submits data and/or engineering evaluations which adequately demonstrate that the misfiring cylinder cannot be reliably identified under certain operating conditions. For diesel engines only, the specific cylinder for which combustion cannot be detected need not be identified if new hardware would be required to do so. The diagnostic trouble

code must identify multiple misfiring cylinder conditions; under multiple misfire conditions, the misfiring cylinders need not be uniquely identified if a distinct multiple misfire diagnostic trouble code is stored.

(3) The diagnostic system may erase a diagnostic trouble code if the same code is not re-registered in at least 40 engine warm-up cycles, and the malfunction indicator light is not illuminated for that code.

(4) Separate status codes, or readiness codes, must be stored in computer memory to identify correctly functioning emission control systems and those emission control systems which require further engine operation to complete proper diagnostic evaluation. A readiness code need not be stored for those monitors that can be considered continuously operating monitors (*e.g.*, misfire monitor, fuel system monitor, etc.). Readiness codes should never be set to ''not ready'' status upon key-on or key-off; intentional setting of readiness codes to ''not ready'' status via service procedures must apply to all such codes, rather than applying to individual codes. Subject to Administrator approval, if monitoring is disabled for a multiple number of driving cycles (i.e., more than one) due to the continued presence of extreme operating conditions (*e.g.*, ambient temperatures below 40°F, or altitudes above 8000 feet), readiness for the subject monitoring system may be set to ''ready'' status without monitoring having been completed. Administrator approval shall be based on the conditions for monitoring system disablement, and the number of driving cycles specified without completion of monitoring before readiness is indicated.

(f) *Available diagnostic data.* (1) Upon determination of the first malfunction of any component or system, ''freeze frame'' engine conditions present at the time must be stored in computer memory. Should a subsequent fuel system or misfire malfunction occur, any previously stored freeze frame conditions must be replaced by the fuel system or misfire conditions (whichever occurs first). Stored engine conditions must include, but are not limited to: engine speed, open or closed loop operation, fuel system commands, coolant temperature, calculated load value, fuel pressure, vehicle speed, air flow rate, and intake manifold pressure if the information needed to determine these conditions is available to the computer. For freeze frame storage, the manufacturer must include the most appropriate set of conditions to facilitate effective repairs. If the diagnostic trouble code causing the conditions to be stored is erased in accordance with paragraph (d) of this section, the stored engine conditions may also be erased.

(2) The following data in addition to the required freeze frame information must be made available on demand through the serial port on the standardized data link connector, if the information is available to the on-board computer or can be determined using information available to the on-board computer: Diagnostic trouble codes, engine coolant temperature, fuel control system status (closed loop, open loop, other), fuel trim, ignition timing advance, intake air temperature, manifold air pressure, air flow rate, engine RPM, throttle position sensor output value, secondary air status (upstream, downstream, or atmosphere), calculated load value, vehicle speed, and fuel pressure. The signals must be provided in standard units based on SAE specifications incorporated by reference in paragraph (h) of this section. Actual signals must be clearly identified separately from default value or limp home signals.

(3) For all OBD systems for which specific on-board evaluation tests are conducted (catalyst, oxygen sensor, *etc.*), the results of the most recent test performed by the vehicle, and the limits to which the system is compared must be available through the standardized data link connector per the appropriate standardized specifications as referenced in paragraph (h) of this section.

(4) Access to the data required to be made available under this section shall be unrestricted and shall not require any access codes or devices that are only available from the manufacturer.

(g) *Exceptions.* The OBD system is not required to evaluate systems or components during malfunction conditions if such evaluation would result in a risk to safety or failure of systems or components. Additionally, the OBD system is not required to evaluate systems or components during operation of a power take-off unit such as a dump bed, snow plow blade, or aerial bucket, *etc.*

(h) *Reference materials.* The OBD system shall provide for standardized access and conform with the following Society of Automotive Engineers (SAE) standards and/or the following International Standards Organization (ISO) standards. The following documents are incorporated by reference (see § 86.1):

(1) *SAE material.* Copies of these materials may be obtained from the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096–0001.

(i) SAE J1850 ''Class B Data Communication Network Interface,'' (July 1995) shall be used as the on-board to off-board communications protocol. All emission related messages sent to the scan tool over a J1850 data link shall use the Cyclic Redundancy Check and the three byte header, and shall not use inter-byte separation or checksums.

(ii) Basic diagnostic data (as specified in §§ 86.094–17(e) and (f)) shall be provided in the format and units in SAE J1979 E/E Diagnostic Test Modes,''(July 1996).

(iii) Diagnostic trouble codes shall be consistent with SAE J2012 ''Recommended Practices for Diagnostic Trouble Code Definitions,'' (July 1996).

(iv) The connection interface between the OBD system and test equipment and diagnostic tools shall meet the functional requirements of SAE J1962 ''Diagnostic Connector,'' (January 1995).

(v) As an alternative to the above standards, heavy-duty engines may conform to the specifications of SAE J1939 ''Recommended Practice for a Serial Control and Communications Vehicle Network.''

(2) *ISO materials.* Copies of these materials may be obtained from the International Organization for Standardization, Case Postale 56, CH–1211 Geneva 20, Switzerland.

(i) ISO 9141–2 ''Road vehicles—Diagnostic systems—Part 2: CARB requirements for interchange of digital information,'' (February 1994) may be used as an alternative to SAE J1850 as the on-board to off-board communications protocol.

(ii) ISO 14230–4 ''Road vehicles—Diagnostic systems—KWP 2000 requirements for Emission-related systems'' may also be used as an alternative to SAE J1850.

(i) *Deficiencies and Alternate Fueled Engines.* Upon application by the manufacturer, the Administrator may accept an OBD system as compliant even though specific requirements are not fully met. Such compliances without meeting specific requirements, or deficiencies, will be granted only if compliance would be infeasible or unreasonable considering such factors as, but not limited to: technical feasibility of the given monitor and lead time and production cycles including phase-in or phase-out of engines or vehicle designs and programmed upgrades of computers. Unmet requirements should not be carried over from the previous model year except where unreasonable hardware or software modifications would be necessary to correct the deficiency, and the manufacturer has demonstrated an acceptable level of effort toward compliance as determined by the Administrator. Furthermore, EPA will not accept any deficiency requests that include the complete lack of a major diagnostic monitor (''major'' diagnostic monitors being those for exhaust aftertreatment devices, oxygen sensor, engine misfire, evaporative leaks, and diesel EGR, if equipped), with the possible exception of the special provisions for alternate fueled engines. For alternate fueled heavy-duty engines (*e.g.* natural gas, liquefied petroleum gas, methanol, ethanol), beginning with the model year for which alternate fuel emission standards are applicable and extending through the 2006 model year, manufacturers may request the Administrator to waive specific monitoring requirements of this section for which monitoring may not be reliable with respect to the use of the alternate fuel. At a minimum, alternate fuel engines must be equipped with an OBD system meeting OBD requirements to the extent feasible as approved by the Administrator.

(j) *California OBDII Compliance Option*. For heavy-duty engines at or below 14,000 pounds GVWR, demonstration of compliance with California OBD II requirements (Title 13 California Code Sec. 1968.1), as modified pursuant to California Mail Out #97–24 (December 9, 1997), shall satisfy the requirements of this section, except that the exemption to the catalyst monitoring provisions of California Code Sec. 1968.1(b)(1.1.2) for diesel engines does not apply, and compliance with California Code Secs. 1968.1(b)(4.2.2), pertaining to 0.02 inch evaporative leak detection, and 1968.1(d), pertaining to tampering protection, are not required to satisfy the requirements of this section. Also, the deficiency fine provisions of California Code Secs. 1968.1(m)(6.1) and (6.2) do not apply.

(k) *Phase-in for Heavy-Duty Engines*. Manufacturers of heavy-duty engines must comply with the OBD requirements in this section according to the following phase-in schedule, based on the percentage of projected engine sales within each category:

OBD COMPLIANCE PHASE-IN HEAVY-DUTY ENGINES

[Intended for use in a heavy-duty vehicle weighing 14,000 pounds GVWR or less]

Model year	Phase-in based on projected sales
2004 MY	—40% compliance. —alternative fuel waivers available.
2005 MY	—60% compliance. —alternative fuel waivers available.
2006 MY	—80% compliance. —alternative fuel waivers available.
2007+ MY	—100% compliance.

17. Section 86.004–21 is amended by adding paragraphs (m) through (p), to read as follows:

§ 86.004–21 Application for certification.

* * * * *

(m) For diesel heavy-duty engines, the manufacturer must provide the following additional information pertaining to the supplemental steady-state test conducted under § 86.1360–2004:

(1) Weighted average emissions data, calculated according to § 86.1360–2004(e)(5), for all pollutants for which an emission standard is established in § 86.004–11(a);

(2) Brake specific gaseous emission data for each of the 13 test points (identified under § 86.1360–2004(b)(1)) and the 3 EPA-selected test points (identified under § 86.1360–2004(b)(2));

(3) Concentrations and mass flow rates of all regulated gaseous emissions plus carbon dioxide;

(4) Exhaust smoke opacity (''k'' value);

(5) Values of all emission-related engine control variables at each test point;

(6) Weighted average particulate matter;

(7) A statement that the test results correspond to the maximum NO_X producing condition for a 30 second or longer averaging period reasonably expected to be encountered at each test point during normal engine operation and use. This statement corresponds to the test requirement under § 86.1360–2004(e)(3). The manufacturer also must provide a detailed description of all testing, engineering analyses, and other information which provides the basis for this statement;

(8) A statement that the engines will comply with the weighted average emissions standard and Maximum Allowable Emission Limits specified in § 86.004–11(a)(3) during all normal engine operation and use. The manufacturer also must provide a detailed description of all testing, engineering analyses, and other information which provides the basis for this statement.

(n) The manufacturer must provide a statement in the application for certification that the diesel heavy-duty engine for which certification is being requested will comply with the applicable Not-To-Exceed Limits specified in § 86.004–11(a)(4) when operated under all conditions which may reasonably be expected to be encountered in normal vehicle operation and use. The manufacturer also must provide a detailed description of all testing, engineering analyses, and other information which provides the basis for this statement.

(o) The manufacturer must provide in each application for certification of a heavy-duty diesel engine emission test results from the Load Response Test conducted according to § 86.1380, including at a minimum test results conducted at each of the speeds identified in § 86.1380.

(p) 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 milers per hour or per kilometer.

18. Section 86.004–30 is amended by revising paragraph (f), to read as follows:

§ 86.004–30 Certification.

* * * * *

(f) For engine families required to have an OBD system, certification will not be granted if, for any test vehicle approved by the Administrator in consultation with the manufacturer, the malfunction indicator light does not illuminate under any of the following circumstances, unless the manufacturer can demonstrate that any identified OBD problems discovered during the Administrator's evaluation will be corrected on production vehicles.

(1)(i) *Otto-cycle.* A catalyst is replaced with a deteriorated or defective catalyst, or an electronic simulation of such, resulting in an increase of 1.5 times the NMHC+NO_X standard or FEL above the NMHC+NO_X emission level measured using a representative 4000 mile catalyst system.

(ii) *Diesel.* If monitored for emissions performance—a catalyst or particulate trap is replaced with a deteriorated or defective catalyst or trap, or an electronic simulation of such, resulting in exhaust emissions exceeding 1.5 times the applicable standard or FEL for NMHC+NO_X or PM. If not monitored for emissions performance—removal of the catalyst or particulate trap is not detected and identified.

(2)(i) *Otto-cycle.* An engine misfire condition is induced resulting in exhaust emissions exceeding 1.5 times the applicable standards or FEL for NMHC+NO_X or CO.

(ii) *Diesel.* An engine misfire condition is induced and is not detected.

(3) If so equipped, any oxygen sensor is replaced with a deteriorated or defective oxygen sensor, or an electronic simulation of such, resulting in exhaust emissions exceeding 1.5 times the applicable standard or FEL for NMHC+NO_X or CO.

(4) If so equipped, a vapor leak is introduced in the evaporative and/or refueling system (excluding the tubing and connections between the purge valve and the intake manifold) greater than or equal in magnitude to a leak caused by a 0.040 inch diameter orifice, or the evaporative purge air flow is blocked or otherwise eliminated from the complete evaporative emission control system.

(5) A malfunction condition is induced in any emission-related engine system or component, including but not necessarily limited to, the exhaust gas recirculation (EGR) system, if equipped, the secondary air system, if equipped, and the fuel control system, singularly resulting in exhaust emissions exceeding 1.5 times the applicable emission standard or FEL for NMHC+NO_X, CO or PM.

(6) A malfunction condition is induced in an electronic emission-related engine system or component not otherwise described above that either provides input to or receives commands from the on-board computer resulting in a measurable impact on emissions.

20. Subpart B is amended by revising the heading of the subpart, to read as follows:

Subpart B—Emission Regulations for 1977 and Later Model Year New Light-Duty Vehicles and New Light-Duty Trucks and New Otto-Cycle Complete Heavy-Duty Vehicles; Test Procedures

21. Section 86.101 is amended by revising paragraphs (a) introductory text and (d), and by adding paragraph (e) to read as follows:

§ 86.101 General applicability.

(a) The provisions of this subpart are applicable to 1997 and later model year new light-duty vehicles and light duty trucks, and 2004 and later model year new Otto-cycle complete heavy-duty vehicles.

* * * * *

(d) References in this subpart to engine families and emission control systems shall be deemed to apply to durability groups and test groups as applicable for manufacturers certifying new light-duty vehicles, light-duty trucks, and Otto-cycle complete heavy-duty vehicles under the provisions of Subpart S of this part.

(e) References in this subpart to light-duty vehicles or light-duty trucks shall be deemed to apply to light-duty vehicles, light-duty trucks, or Otto-cycle complete heavy-duty vehicles as applicable for manufacturers certifying new light-duty vehicles, light-duty trucks, and Otto-cycle complete heavy-duty vehicles under the provisions of Subpart S of this part.

22. Section 86.129–94 is amended by revising paragraph (a) to read as follows:

§ 86.129–94 Road load power, test weight, inertia weight class determination, and fuel temperature profile.

* * * * *

(a) Flywheels, electrical, or other means of simulating test weight as shown in the following table shall be used. If the equivalent test weight specified is not available on the dynamometer being used, the next higher equivalent test weight (not to exceed 250 pounds) available shall be used:

Test weight basis [4,5]	Equivalent test weight (pounds)	Inertia weight class (pounds)
Road load power at 50 mi/hour—light-duty trucks [1,2,3]		
Up to 1062	1,000	1,000
1063 to 1187	1,125	1,000
1188 to 1312	1,250	1,250
1313 to 1437	1,375	1,250
1438 to 1562	1,500	1,500
1563 to 1687	1,625	1,500
1688 to 1812	1,750	1,750
1813 to 1937	1,875	1,750
1938 to 2062	2,000	2,000
2063 to 2187	2,125	2,000
2188 to 2312	2,250	2,250
2313 to 2437	2,375	2,250
2438 to 2562	2,500	2,500
2563 to 2687	2,625	2,500
2688 to 2812	2,750	2,750
2813 to 2937	2,875	2,750
2938 to 3062	3,000	3,000
3063 to 3187	3,125	3,000
3188 to 3312	3,250	3,000
3313 to 3437	3,375	3,500

Test weight basis [4,5]	Equivalent test weight (pounds)	Inertia weight class (pounds)
3438 to 3562	3,500	3,500
3563 to 3687	3,625	3,500
3688 to 3812	3,750	3,500
3813 to 3937	3,875	4,000
3938 to 4125	4,000	4,000
4126 to 4375	4,250	4,000
4376 to 4625	4,500	4,500
4626 to 4875	4,750	4,500
4876 to 5125	5,000	5,000
5126 to 5375	5,250	5,000
5376 to 5750	5,500	5,500
5751 to 6250	6,000	6,000
6251 to 6750	6,500	6,500
6751 to 7250	7,000	7,000
7251 to 7750	7,500	7,500
7751 to 8250	8,000	8,000
8251 to 8750	8,500	8,500
8751 to 9250	9,000	9,000
9251 to 9750	9,500	9,500
9751 to 10250	10,000	10,000
10251 to 10750	10,500	10,500
10751 to 11250	11,000	11,000
11251 to 11750	11,500	11,500
11751 to 12250	12,000	12,000
12251 to 12750	12,500	12,500
12751 to 13250	13,000	13,000
13251 to 13750	13,500	13,500
13751 to 14000	14,000	14,000

[1] For all light-duty trucks except vans, and for heavy-duty vehicles optionally certified as light-duty trucks, and for complete heavy-duty vehicles, the road load power (horsepower) at 50 mi/h shall be 0.58 times B (defined in footnote 3 of this table) rounded to the nearest ½ horsepower.

[2] For vans, the road load power at 50 mi/h (horsepower) shall be 0.50 times B (defined in footnote 3 of this table) rounded to the nearest ½ horsepower.

[3] B is the basic vehicle frontal area (square foot) plus the additional frontal area (square foot) of mirrors and optional equipment exceeding 0.1 ft^2 which are anticipated to be sold on more than 33 percent of the car line. Frontal area measurements shall be computed to the nearest 10^{th} of a square foot using a method approved in advance by the Administrator.

[4] For model year 1994 and later heavy light-duty trucks not subject to the Tier 0 standards of § 86.094–9, test weight basis is as follows: for emissions tests, the basis shall be adjusted loaded vehicle weight, as defined in § 86.094–2; and for fuel economy tests, the basis shall be loaded vehicle weight, as defined in § 86.082–2, or, at the manufacturer's option, adjusted loaded vehicle weight as defined in § 86.094–2. For all other vehicles, test weight basis shall be loaded vehicle weight, as defined in § 86.082–2.

[5] Light-duty vehicles over 5,750 lb. loaded vehicle weight shall be tested at a 5,500 lb. equivalent test weight.

* * * * *

Subpart H—[Amended]

23. Section 86.701–94 is revised to read as follows:

§ 86.701–94 General applicability.

(a) The provisions of this subpart apply to: 1994 and later model year Otto-cycle and diesel light-duty vehicles; 1994 and later model year Otto-cycle and diesel light-duty trucks; and 1994 and later model year Otto-cycle and diesel heavy-duty engines; and 2004 and later model year Otto-cycle complete heavy-duty vehicles. The provisions of subpart B of this part apply to this subpart.

(b) References in this subpart to engine families and emission control systems shall be deemed to apply to durability groups and test groups as applicable for manufacturers certifying new light-duty vehicles, light-duty trucks, and Otto-cycle complete heavy-duty vehicles under the provisions of subpart S of this part.

Subpart K—[Amended]

24. Section 86.1001–84 is amended by revising paragraph (b), to read as follows:

§ 86.1001–84 Applicability.

* * * * *

(b) References in this subpart to engine families and emission control systems shall be deemed to apply to durability groups and test groups as applicable for manufacturers certifying new light-duty vehicles, light-duty trucks, and Otto-cycle complete heavy-duty vehicles under the provisions of subpart S of this part.

Subpart L—[Amended]

25. Section 86.1101–87 is revised to read as follows:

§ 86.1101–87 Applicability.

(a) The provisions of this subpart are applicable for 1987 and later model year gasoline-fueled and diesel heavy-duty engines and heavy-duty vehicles. These vehicles include light-duty trucks rated in excess of 6,000 pounds gross vehicle weight.

(b) References in this subpart to engine families and emission control systems shall be deemed to apply to durability groups and test groups as applicable for manufacturers certifying new light-duty trucks and Otto-cycle complete heavy-duty vehicles under the provisions of subpart S of this part.

Subpart N—[Amended]

26. Section 86.1304–90 is revised to read as follows:

§ 86.1304–90 Section numbering; construction.

(a) *Section numbering.* The model year of initial applicability is indicated by the section number. The two digits following the hyphen designate the first model year for which a section is applicable. The section continues to apply to subsequent model years unless a later model year section is adopted.

Example: Section 86.18xx–01 applies to the 2001 and subsequent model years. If a

Sec. 86.18xx–03 is promulgated it would apply beginning with the 2003 model year; Sec. 86.18xx-01 would apply to model years 2001 through 2002.

(b) A section reference without a model year suffix refers to the section applicable for the appropriate model year.

27. A new § 86.1305–2004 is added to subpart N, to read as follows:

§ 86.1305–2004 Introduction; structure of subpart.

(a) This subpart describes the equipment required and the procedures to follow in order to perform exhaust emissions test on Otto-cycle and diesel heavy duty engines. Subpart A of this part sets forth the emission standards and general testing requirements to comply with EPA certification procedures.

(b) This subpart contains five key sets of requirements, as follows: specifications and equipment needs (§§ 86.1306 through 86.1314); calibration methods and frequencies (§§ 86.1316 through 86.1326); test procedures (§§ 86.1327 through 86.1341 and §§ 86.1360 through 86.1380); calculation formulas (§§ 86.1342 and 86.1343); and data requirements (§ 86.1344).

29. A new § 86.1360–2004 is added to subpart N to read as follows:

§ 86.1360–2004 Supplemental steady-state test; test cycle and procedures.

(a) *Applicability.* This section applies to diesel heavy duty engines.

(b) *Test cycle.* (1) The following 13-mode cycle must be followed in dynamometer operation on the test engine:

Mode No.	Engine speed	Percent load	Weighting factor	Mode length (minutes)
1	Idle	....	0.15	4
2	A	100	0.08	2
3	B	50	0.10	2
4	B	75	0.10	2
5	A	50	0.05	2
6	A	75	0.05	2
7	A	25	0.05	2
8	B	100	0.09	2
9	B	25	0.10	2
10	C	100	0.08	2
11	C	25	0.05	2
12	C	75	0.05	2
13	C	50	0.05	2

(2) In addition to the 13 test points identified in paragraph (b)(1) of this section, EPA may select, and require the manufacturer to conduct the test using, up to 3 additional test points within the control area (as defined in paragraph (d) of this section). EPA will notify the manufacturer of these supplemental test points in writing in a timely manner before the test.

(c) *Determining Engine Speeds.* (1) The engine speeds A, B and C, referenced in the table in paragraph (b)(1) of this section, and speeds D and E, referenced in § 86.1380, must be determined as follows:

Speed A = n_{lo} + 25% ($n_{hi} - n_{lo}$)
Speed B = n_{lo}+ 50% ($n_{hi} - n_{lo}$)
Speed C = n_{lo} + 75% ($n_{hi} - n_{lo}$)
Speed D = n_{lo} + 100% ($n_{hi} - n_{lo}$)
Speed E = n_{lo} + 15% ($n_{hi} - n_{lo}$)

Where:

n_{hi} = High speed as determined by calculating 70% of the maximum power. The highest engine speed where this power value occurs on the power curve is defined as n_{hi}.

n_{lo} = Low speed as determined by calculating 50% of the maximum power. The lowest engine speed where this power value occurs on the power curve is defined as n_{lo}.

Maximum power = the maximum observed power calculated from the torque/speed ratios determined according to the engine mapping procedures defined in § 86.1332. Power = (speed × torque)/5252, where speed is in revolutions per minute and torque is in foot-pounds.

(2) If the measured engine speeds A, B, and C are within 3 % of the engine speeds as declared by the manufacturer, the declared engine speeds shall be used for the emissions test. If the tolerance is exceeded for any of the engine speeds, the measured engine speeds shall be used for the emissions test.

(d) *Determining the control area.* The control area is the area between the engine speeds A and C, as defined in paragraph (c) of this section, and between 25 to 100 percent load.

(e) *Test requirements.* (1) *Engine warm-up.* Prior to beginning the test sequence, the engine must be warmed-up according to the procedures in § 86.1332–90(d)(3).

(2) *Test sequence.* The test must be performed in the order of the mode numbers in paragraph (b)(1) of this section. The EPA-selected test points identified under paragraph (b)(2) of this section must be performed immediately upon completion of mode 13. The engine must be operated for the prescribed time in each mode, completing engine speed and load changes in the first 20 seconds of each mode. The specified speed must be held to within ±50 rpm and the specified torque must be held to within ±2 percent of the maximum torque at the test speed.

(3) The test must be conducted with all emission-related engine control variables in the highest brake-specific NO_X emissions state which could be encountered for a 30 second or longer averaging period at the given test point.

(4) *Exhaust emissions measurements and calculations.* (i) Manufacturers must follow the exhaust emissions sample analysis procedures under § 86.1340, and the calculation formulas and procedures under § 86.1342, for the 13-mode cycle and the 3 EPA-selected test points.

(ii) Prior to starting the measurements for the EPA-selected test points, the engine must be conditioned at mode 13 for a period of three minutes.

(5) *Calculating the weighted average emissions.* For each regulated gaseous pollutant, the weighted average emissions must be calculated as follows:

$$A_{WA} = \sum_{i=1}^{n} \left[A_{WMi} \times WF_i \right]$$

Where:

A_{WA} = Weighted average emissions for each regulated gaseous pollutant, in grams per brake horse-power hour.

A_{WM} = Weighted mass emissions level, in grams per brake horse-power hour, as defined in § 86.1342.

W_F = Weighting factor corresponding to each mode of the steady-state test cycle, as defined in paragraph (b)(1) of this section.

i = The modes of the steady-state test cycle, as defined in paragraph (b)(1) of this section.

n = 13, corresponding to the 13 modes of the steady-state test cycle, as defined in paragraph (b)(1) of this section.

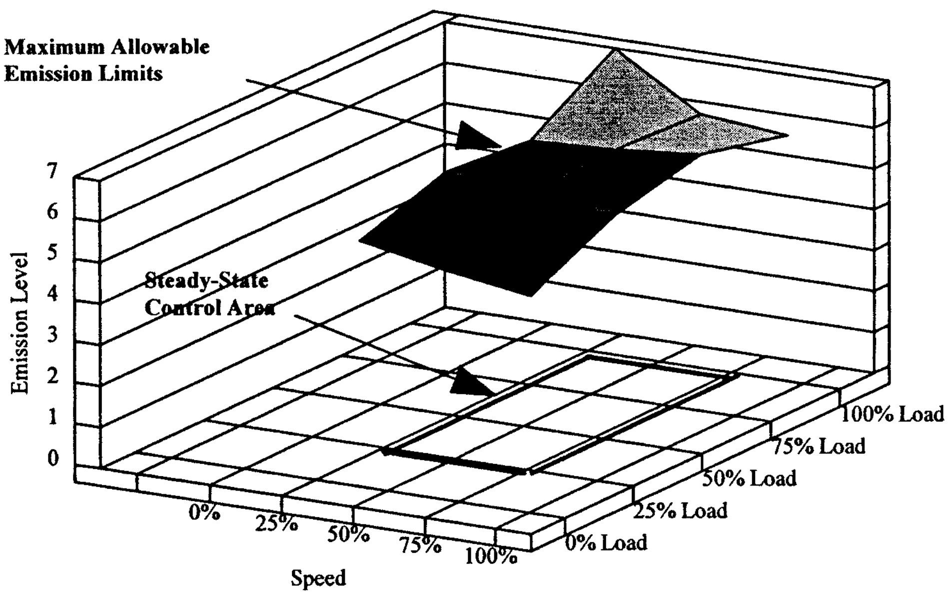
(f) *Maximum Allowable Emission Limits.* (1) For gaseous emissions, the 12 non-idle test point results and the four-point linear interpolation procedure specified in paragraph (g) of this section for intermediate conditions, shall define Maximum Allowable Emission Limits for purposes of § 86.004–11(a)(3). The control area extends from the 25% to the 75% engine speeds, at engine loads of 25% to 100%, as defined in paragraph (d) of this section. Figure 1 of this paragraph (f)(1) depicts a sample Maximum Allowable Emission Limit curve, for illustration purposes only, as follows:

BILLING CODE 6560–50–P

Figure 1

Maximum Allowable Emission Limits

Sample - For Illustration Only



BILLING CODE 6560–50–C

(2) If the weighted average emissions, calculated according to paragraph (e)(5) of this section, for any gaseous pollutant is lower than required by § 86.004–11(a)(3), each of the 13 test values for that pollutant shall first be multiplied by the ratio of the applicable emission standard (under § 86.004–11(a)(3)) to the weighted average emissions value, and then by 1.05 for interpolation allowance, before determining the Maximum Allowable Emission Limits under paragraph (f)(1) of this section.

(3) If the Maximum Allowable Emission Limit for any point, as calculated under paragraphs (f)(1) and (2) of this section, is greater than the applicable Not-to-Exceed limit (if within the Not-to-Exceed control area defined in § 86.1370–2004(b)), then the Maximum Allowable Emission Limit for that point shall be defined as the applicable Not-to-Exceed limit.

(g) *Calculating intermediate test points.* (1) For the three test points selected by EPA under paragraph (b)(2) of this section, the emissions must be measured and calculated according to § 86.1342 and also determined by interpolation from the modes of the test cycle closest to the respective test point according to paragraph (g)(2) of this section. The measured values then must be compared to the interpolated values according to paragraph (g)(3) of this section.

(2) *Interpolating emission values from the test cycle.* The gaseous emissions for each regulated pollutant for each of the control points (Z) must be interpolated from the four closest modes of the test cycle that envelop the selected control point Z as shown in Figure 2 of this paragraph (g)(2).

(i) For these modes (R, S, T, U), the following definitions apply:

Speed (R) = Speed(T) = n_{RT}
Speed (S) = Speed(U) = n_{SU}
Per cent load (R) = Per cent load (S)
Per cent load (T) = Per cent load (U)

(ii) The gaseous emissions of the selected control point (Z) must be calculated as follows:

$E_Z = E_{RS} + (E_{TU} - E_{RS}) * (M_Z - M_{RS})/(M_{TU} - M_{RS})$

$E_{TU} = E_T + (E_U - E_T)*(n_Z - n_{RT})/(n_{SU} - n_{RT})$

$E_{RS} = E_R + (E_S - E_R)*(n_Z - n_{RT})/(n_{SU} - n_{RT})$

$M_{TU} = M_T+(M_U - M_T)*(n_Z - n_{RT})/(n_{SU} - n_{RT})$

(E) $M_{RS} = M_R+(M_S - M_R)*(n_Z - n_{RT})/(n_{SU} - n_{RT})$

Where:

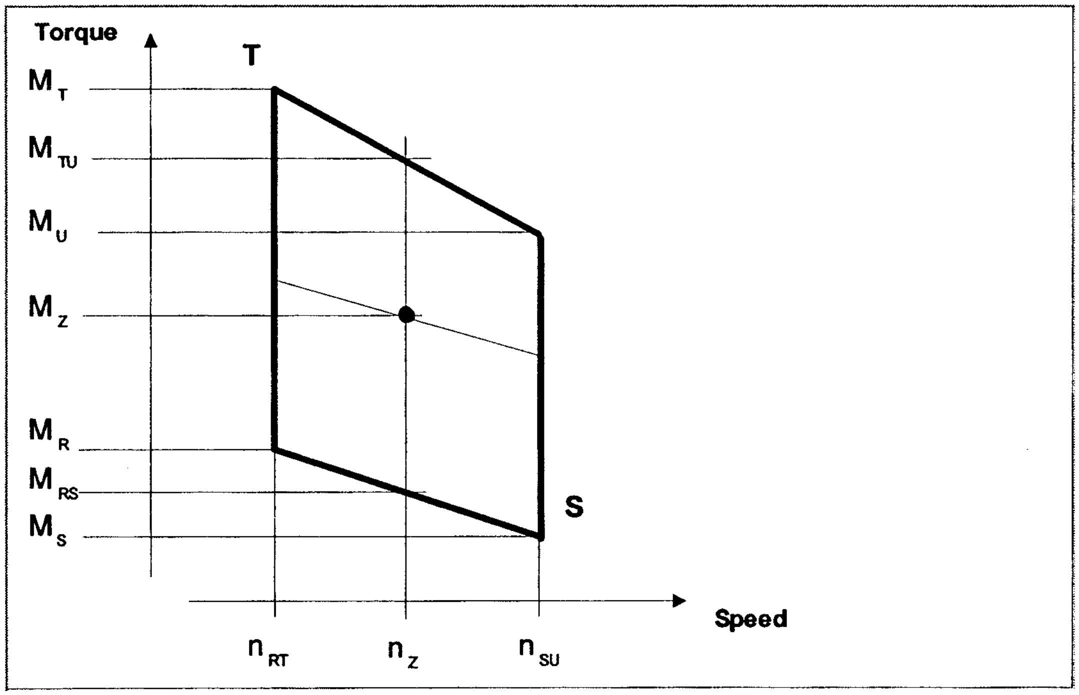
E_R, E_S, E_T, E_U = for each regulated pollutant, specific gaseous emissions of the enveloping modes calculated in accordance with § 86.1342.

M_R, M_S, M_T, M_U = engine torque of the enveloping modes.

(iii) Figure 2 follows:

BILLING CODE 6560–50–P

Figure 2
Four-Point Linear Interpolation



BILLING CODE 6560–50–C

(3) *Comparing calculated and interpolated emission values.* The measured specific gaseous emissions of the control point Z (X_Z) must be compared to the interpolated value (E_Z) as follows:

$X_{diff} = 100*(X_Z - E_Z)/E_Z$

30. A new § 86.1361–2004 is added to subpart N, to read as follows:

§ 86.1361–2004 Maximum allowable emission limits; compliance in actual operation.

(a) *Applicability.* This section applies to diesel heavy-duty engines.

(b) *General.* Compliance with the Maximum Allowable Emission Limits under § 86.004–11(a)(3)(ii) may be determined under any conditions that may reasonably be expected to be encountered in normal vehicle operation and use. The engine may be tested in a vehicle in actual use or on a dynamometer, under steady state or transient conditions, and under varying ambient conditions. To determine compliance, test results within the control area, defined in § 86.1360–2004(d), shall be compared to the Maximum Allowable Emission Limits, as determined in § 86.1360–2004(f), for the same engine speed and load. The engine, when operated within the control area, must comply with the Maximum Allowable Emission Limits.

(c) *Test conditions.* Where the test conditions identified in paragraph (b) of this section require departure from specific provisions of this subpart (*e.g.*, sampling time), testing shall be conducted using good engineering practices. The manufacturer shall submit a detailed description of any departures from the specific testing provisions of this subpart and the justification for modifying the test procedures, along with any test results submitted to EPA.

(1) If EPA requires engine dynamometer testing by the manufacturer outside of FTP conditions, such testing may be done at the manufacturer's facility on existing equipment, and must be carried out only within the limits of operation of the manufacturer's available test equipment with regard to ambient temperature, humidity and altitude. EPA may conduct its own testing at any ambient temperature, humidity or altitude.

(2) When tested under transient conditions, emission values to be compared to the Maximum Allowable Emission Limits shall represent an average of at least 30 seconds.

(3) NO_X emissions shall be corrected for humidity to a standard level of 75 grains of water per pound of dry air. Outside the temperature range of 68–86 degrees F, NO_X and PM emissions shall be corrected to 68 degrees F if below 68 degrees F, or to 86 degrees F if above 86 degrees F. Where a manufacturer test requires such correction factors, the manufacturer must use good engineering judgement and generally accepted engineering practice to determine the appropriate correction factors, subject to EPA review.

31. A new § 86.1370–2004 is added to subpart N, to read as follows:

§ 86.1370–2004 Not-To-Exceed test procedures.

(a) *General.* The purpose of this test procedure is to measure in-use emissions of heavy-duty diesel engines while operating within a broad range of speed and load points (the Not-To-Exceed Control Area) and under conditions which can reasonably be expected to be encountered in normal vehicle operation and use. Emission results from this test procedure are to be compared to the Not-To-Exceed Limits specified in § 86.004–11 (a)(4).

(b) *Not-To-Exceed Control Area for diesel heavy-duty engines.* The Not-To-Exceed Control Area for diesel heavy-duty engines consists of the following engine speed and load points:

(1) All operating speeds greater than the speed calculated using the following formula, where n_{hi} and n_{lo} are determined according to the provisions in § 86.1360(c):

$n_{lo}+0.15n_{hi}(n_{hi}-n_{lo})$

(2) All engine load points greater than or equal to 30% or more of the maximum torque value produced by the engine.

(3) Notwithstanding the provisions of paragraphs (b)(1) and (b)(2) of this section, all operating speed and load points with brake specific fuel consumption (BSFC) values within 5% of the minimum BSFC value of the engine. The manufacturer may petition the Administrator at certification to exclude such points if the manufacturer can demonstrate that the engine is not expected to operate at such points in normal vehicle operation and use. Engines equipped with drivelines with multi-speed manual transmissions or automatic transmissions with a finite number of gears are not subject the requirements of this paragraph (b)(3).

(4) Notwithstanding the provisions of paragraphs (b)(1) through (b)(3) of this section, speed and load points below 30% of the maximum power value produced by the engine shall be excluded from the Not-To-Exceed Control Area for all emissions.

(5) For particulate matter only, speed and load points determined by one of the following methods, whichever is applicable, shall be excluded from the Not-To-Exceed Control Area. B and C engine speeds shall be determined according to the provisions of § 86.1350 (c):

(i) If the C speed is below 2400 rpm, the speed and load points to the right of or below the line formed by connecting the following two points:

(A) 30% of maximum torque or 30% of maximum power, whichever is greater, at the B speed;

(B) 70% of maximum power at 100% speed (n_{hi});

(ii) If the C speed is above 2400 rpm, the speed and load points to the right of the line formed by connecting the two points in paragraphs (b)(5)(ii)(A) and (B) of this section and below the line formed by connecting the two points in paragraphs (b)(5)(ii)(B) and (C) of this section:

(A) 30% of maximum torque or 30% of maximum power, whichever is greater, at the B speed;

(B) 50% of maximum power at 2400 rpm;

(C) 70% of maximum power at 100% speed (n_{hi}).

(c) [Reserved]

(d) *Not-To-Exceed Control Area Limits.* (1) When operated within the Not-To-Exceed Control Area defined in paragraph (b) of this section, diesel engine emissions shall not exceed the applicable Not-To-Exceed Limits specified in § 86.004–11 (a)(4) when averaged over any period of time greater than or equal to 30 seconds.

(2) [Reserved]

(e) *Ambient Corrections.* The measured data shall be corrected based on the ambient conditions under which it was taken. The temperature and humidity correction factors will be based on good engineering practice.

(1) NO_X emissions shall be corrected for humidity to a standard humidity level of 50 grains (7.14 g/kg) if the humidity of the intake air was below 50 grains, or to 75 grains (10.71 g/kg) if above 75 grains.

(2) NO_X and PM emissions shall be corrected for temperature to a temperature of 55 degrees F (12.8 degrees C) for intake air temperatures below 55 degrees F or to 95 degrees F (35.0 degrees C) if the intake air is above 95 degrees F.

(3) No temperature or humidity correction factors shall be used within the ranges of 50–75 grains or 55–95 degrees F.

33. A new § 86.1372–2004 is added to subpart N, to read as follows:

§ 86.1372–2004 Measuring smoke emissions.

This section contains the measurement techniques to be used for determining compliance with the filter smoke limit or opacity limits in § 86.004–11(b)(1)(iv).

(a) For steady-state or transient smoke testing using full-flow opacimeters, equipment meeting the requirements of subpart I of this part or ISO/DIS–11614 ''Reciprocating internal combustion compression-ignition engines—Apparatus for measurement of the opacity and for determination of the light absorption coefficient of exhaust gas' is required. This document is incorporated by reference (see § 86.1).

(1) All full-flow opacimeter measurements shall be reported as the equivalent percent opacity for a five inch effective optical path length using the Beer-Lambert relationship.

(2) Zero and full-scale (100 percent opacity) span shall be adjusted prior to testing.

(3) Post test zero and full scale span checks shall be performed. For valid tests, zero and span drift between the pre-test and post-test checks shall be less than two percent of full-scale.

(4) Opacimeter calibration and linearity checks shall be performed using manufacturer's recommendations or good engineering practice.

(b) For steady-state testing using a filter-type smokemeter, equipment meeting the requirements of ISO/FDIS–10054 ''Internal combustion compression-ignition engines—Measurement apparatus for smoke from engines operating under steady-state conditions—Filter-type smokemeter'' is recommended.

(1) All filter-type smokemeter results shall be reported as a filter smoke number (FSN) that is similar to the Bosch smoke number (BSN) scale.

(2) Filter-type smokemeters shall be calibrated every 90 days using manufacturer's recommended practices or good engineering practice.

(c) For steady-state testing using a partial-flow opacimeter, equipment meeting the requirements of ISO–8178–3 and ISO/DIS–11614 is recommended.

(1) All partial-flow opacimeter measurements shall be reported as the equivalent percent opacity for a five inch effective optical path length using the Beer-Lambert relationship.

(2) Zero and full scale (100 percent opacity) span shall be adjusted prior to testing.

(3) Post-test zero and full scale span checks shall be performed. For valid tests, zero and span drift between the pre-test and post-test checks shall be less than two percent of full scale.

(4) Opacimeter calibration and linearity checks shall be performed using manufacturer's recommendations or good engineering practice.

(d) Replicate smoke tests may be run to improve confidence in a single test or stabilization. If replicate tests are run, three additional valid tests shall be run, and the final reported test results must be the average of all the valid tests.

(e) A minimum of thirty seconds sampling time shall be used for average transient smoke measurements.

34. A new § 86.1380–2004 is added to subpart N, to read as follows:

§ 86.1380–2004 Load response test.

(a) *General.* The purpose of this test procedure is to measure the gaseous and particulate emissions from an engine as it is suddenly loaded, with its fueling lever, at a given engine operating speed. This procedure shall be conducted on a dynamometer.

(b) *Test sequence.* (1) At each of the following speeds, the engine fuel control shall be moved suddenly to the full fuel position and held at that point for a minimum of two seconds, while the specified speed is maintained constant:

(i) The lowest speed in the Not-To-Exceed Control area determined according to the provisions of § 86.1370;

(ii) Speed A as determined in § 86.1360(c);

(iii) Speed B as determined in § 86.1360(c);

(iv) Speed C as determined in § 86.1360(c);

(v) Speed D as determined in § 86.1360(c);

(vi) Speed E as determined in § 86.1360(c).

(2) This test sequence may be repeated if it is necessary to obtain sufficient sample amount for analysis.

(3) The exhaust emissions sample shall be analyzed according to the procedures under § 86.1340, and the exhaust emission shall be calculated according to the procedures under § 86.1342.

Subpart P—[Amended]

35. Section 86.1501–94 is revised to read as follows:

§ 86.1501–94 Scope; applicability.

(a) This subpart contains gaseous emission idle test procedures for light-duty trucks and heavy-duty engines for which idle CO standards apply. It applies to 1994 and later model years. The idle test procedures are optionally applicable to 1994 through 1996 model year natural gas-fueled and liquified petroleum gas-fueled light-duty trucks and heavy-duty engines.

(b) References in this subpart to engine families and emission control systems shall be deemed to apply to durability groups and test groups as applicable for manufacturers certifying new light-duty trucks and Otto-cycle complete heavy-duty vehicles under the provisions of Subpart S of this part.

Subpart Q—[Amended]

36. Section 86.1601 is amended by revising paragraph (d), to read as follows:

§ 86.1601 General applicability.

* * * * *

(d) References in this subpart to engine families and emission control systems shall be deemed to apply to durability groups and test groups as applicable for manufacturers certifying new light-duty vehicles, light-duty trucks, and Otto-cycle complete heavy-duty vehicles under the provisions of Subpart S of this part.

37. Subpart S is amended by revising the subpart heading to read as follows:

Subpart S—General Compliance Provisions for Control of Air Pollution From New and In-Use Light-Duty Vehicles, Light-Duty Trucks, and Complete Otto-Cycle Heavy-Duty Vehicles

38. Section 86.1801–01 is amended by revising paragraphs (a), (b), (c), and the last sentence of paragraph (d), to read as follows:

§ 86.1801–01 Applicability.

(a) *Applicability.* The provisions of this subpart apply to 2001 and later model year new Otto-cycle and diesel-cycle light-duty vehicles, 2001 and later model year new Otto-cycle and diesel-cycle light-duty trucks, and 2004 and later model year Otto-cycle complete heavy-duty vehicles. These provisions also apply to 2001 model year and later new incomplete light-duty trucks below 8,500 Gross Vehicle Weight Rating, and to 2000 and later model year Otto-cycle complete heavy-duty vehicles participating in the early banking provisions of the averaging, trading, and banking program under the provisions of § 86.1817–04(n). In cases where a provision applies only to a certain vehicle group based on its model year, vehicle class, motor fuel, engine type, or other distinguishing characteristics, the limited applicability is cited in the appropriate section of this subpart.

(b) *Aftermarket conversions.* The provisions of this subpart apply to aftermarket conversions of all model year Otto-cycle and diesel-cycle light-duty vehicles, light-duty trucks, and complete Otto-cycle heavy-duty vehicles as defined in 40 CFR 85.502.

(c) *Optional applicability.* (1) A manufacturer may request to certify any Otto-cycle heavy-duty vehicle of 14,000 pounds Gross Vehicle Weight Rating or less in accordance with the light-duty truck provisions through the 2003 model year. Heavy-duty engine or heavy-duty vehicle provisions of subpart A of this part do not apply to such a vehicle.

(2) Beginning with the 2001 model year, a manufacturer may request to certify any incomplete Otto-cycle heavy-duty vehicle of 14,000 pounds Gross Vehicle Weight Rating or less in accordance with the provisions for complete heavy-duty vehicles. Heavy-duty engine or heavy-duty vehicle provisions of subpart A of this part do not apply to such a vehicle.

(3) A manufacturer may optionally use the provisions of this subpart in lieu of the provisions of subpart A beginning with the 2000 model year for light-duty vehicles and light-duty trucks. Manufacturers choosing this option must comply with all provisions of this subpart. Manufacturers may elect this provision for either all or a portion of their product line.

(4) Upon preapproval by the Administrator, a manufacturer may optionally certify an aftermarket conversion of a complete heavy-duty vehicle greater than 10,000 pounds Gross Vehicle Weight Rating and of 14,000 pounds Gross Vehicle Weight Rating or less under the heavy-duty engine or heavy-duty vehicle provisions of subpart A of this part. Such preapproval will be granted only upon demonstration that chassis-based certification would be infeasible or unreasonable for the manufacturer to perform.

(5) A manufacturer may optionally certify an aftermarket conversion of a complete heavy-duty vehicle greater than 10,000 pounds Gross Vehicle Weight Rating and of 14,000 pounds Gross Vehicle Weight Rating or less under the heavy-duty engine or heavy-duty vehicle provisions of subpart A of this part without advance approval from the Administrator if the vehicle was originally certified to the heavy-duty engine or heavy-duty vehicle provisions of subpart A of this part.

(d) * * * The small volume manufacturer's light-duty vehicle, light-duty truck and complete heavy-duty vehicle certification procedures are described in § 86.1838–01.

* * * * *

39. Section 86.1803–01 is amended by revising the definitions for ''Car line,'' ''Curb idle,'' ''Durability useful life,'' and ''Van,'' and by adding new definitions in alphabetical order, to read as follows:

§ 86.1803–01 Definitions.

* * * * *

Averaging for chassis-bases heavy-duty vehicles means the exchange of NO_X emission credits among test groups within a given manufacturer's product line.

Averaging set means a subcategory of complete heavy-duty vehicles within which test groups can average and trade emission credits with one another.

* * * * *

Banking means the retention of NO_X emission credits for complete heavy-duty vehicles by the manufacturer generating the emission credits, for use in future model year certification programs as permitted by regulation.

* * * * *

Car line means a name denoting a group of vehicles within a make or car division which has a degree of commonality in construction (e.g., body, chassis). Car line does not consider any level of decor or opulence and is not generally distinguished by characteristics as roofline, number of doors, seats, or windows except for station wagons or light-duty trucks. Station wagons, light-duty trucks, and complete heavy-duty vehicles are considered to be different car lines than passenger cars.

* * * * *

Complete heavy-duty vehicle means any Otto-cycle heavy-duty vehicle of 14,000 pounds Gross Vehicle Weight Rating or less that is not an incomplete heavy-duty vehicle.

* * * * *

Curb-idle means, for manual transmission code motor vehicles, the engine speed with the transmission in neutral or with the clutch disengaged and with the air conditioning system, if present, turned off. For automatic transmission code motor vehicles, curb-idle means the engine speed with the automatic transmission in the park position (or neutral position if there is no park position), and with the air conditioning system, if present, turned off.

* * * * *

Durability useful life means the highest useful life mileage out of the set of all useful life mileages that apply to a given vehicle. The durability useful life determines the duration of service accumulation on a durability data vehicle. The determination of durability useful life shall reflect any light-duty truck or complete heavy-duty vehicle alternative useful life periods approved by the Administrator under § 86.1805–01(c). The determination of durability useful life shall exclude any standard and related useful life mileage for which the manufacturer has obtained a waiver of emission data submission requirements under § 86.1829–01.

* * * * *

Emission credits mean the amount of emission reductions or exceedances, by a complete heavy-duty vehicle test group, below or above the emission standard, respectively. Emission credits below the standard are considered as ''positive credits,'' while emission credits above the standard are considered as ''negative credits.'' In addition, ''projected credits'' refer to emission credits based on the projected U.S. production volume of the test group. ''Reserved credits'' are emission credits generated within a model year waiting to be reported to EPA at the end of the model year. ''Actual credits'' refer to emission credits based on actual U.S. production volumes as contained in the end-of-year reports submitted to EPA. Some or all of these credits may be revoked if EPA review of the end of year reports or any subsequent audit actions uncover problems or errors.

* * * * *

Family emission limit (FEL) means an emission level declared by the manufacturer which serves in lieu of an emission standard for certification purposes in the averaging, trading and banking program. FELs must be expressed to the same number of decimal places as the applicable emission standard.

* * * * *

Incomplete heavy-duty vehicle means any heavy-duty vehicle which does not have the primary load carrying device or container attached.

* * * * *

Non-methane organic gas means the sum of oxegenated and non-oxygenated hydrocarbons contained in a gas sample.

* * * * *

Trading means the exchange of complete heavy-duty vehicle NO_X emission credits between manufacturers.

* * * * *

Van means a light-duty truck or complete heavy-duty vehicle having an integral enclosure, fully enclosing the driver compartment and load carrying device, and having no body sections protruding more than 30 inches ahead of the leading edge of the windshield.

* * * * *

40. A new section 86.1803–04 is added to subpart S, to read as follows:

§ 86.1803–04 Definitions.

The definitions of § 86.1803–01 continue to apply to this subpart. The definitions listed in this section apply to this subpart beginning with the 2004 model year.

Heavy-duty vehicle means any motor vehicle rated at more than 8,500 pounds GVWR or that has a vehicle curb weight of more than 6,000 pounds or that has a basic vehicle frontal area in excess of 45 square feet, excluding vehicles with a GVWR greater than 8,500 pounds and less than or equal to 10,000 pounds that are defined as light-duty trucks.

Light-duty truck means:

(1) Any motor vehicle rated at 8,500 pounds GVWR or less which has a curb weight of 6,000 pounds or less and which has a basic vehicle frontal area of 45 square feet or less, which is:

(i) Designed primarily for purposes of transportation of property or is a derivation of such a vehicle; or

(ii) Designed primarily for transportation of persons and has a capacity of more than 12 persons; or

(iii) Available with special features enabling off-street or off-highway operation and use; or

(2) Any motor vehicle rated at greater than 8,500 pounds GVWR and less than or equal to 10,000 pounds GVWR which is a complete vehicle designed primarily for transportation of persons and has a capacity of not more than 12 persons.

41. Section 86.1804–01 is amended by adding ''FEL,'' ''NMOG,'' and ''HDV'' as new abbreviations in alphabetical order, to read as follows:

§ 86.1804–01 Acronyms and abbreviations.

* * * * *

FEL—Family Emission Limit

* * * * *

HDV—Heavy-duty vehicle

* * * * *

NMOG—Non-Methane Organic Gas

* * * * *

42. Section 86.1805–01 is amended by revising paragraph (a) and the first and last sentences of paragraph (c), and adding paragraph (b)(3), to read as follows:

§ 86.1805–01 Useful life.

(a) For light-duty vehicles and light-duty trucks, intermediate useful life is a period of use of 5 years or 50,000 miles, which ever occurs first.

(b) * * *

(3) For complete heavy-duty vehicles, the full useful life is a period of use of 11 years or 120,000 miles, which ever occurs first.

(c) Manufacturers may petition the Administrator to provide alternative useful life periods for light-duty trucks or complete heavy-duty vehicles when they believe that the useful life periods are significantly unrepresentative for one or more test groups (either too long or too short). * * * For light-duty trucks, alternative useful life periods will be granted only for THC, THCE, and idle CO requirements.

43. A new § 86.1806–04 is added to subpart S, to read as follows:

§ 86.1806–04 On-board diagnostics.

(a) *General.* All light-duty vehicles, light-duty trucks, and heavy-duty vehicles intended for use in a heavy-duty vehicle weighing 14,000 pounds GVWR or less must be equipped with an on-board diagnostic (OBD) system capable of monitoring all emission-related powertrain systems or components during the applicable useful life. Heavy-duty vehicles intended for use in a heavy-duty vehicle weighing 14,000 pounds GVWR or less must meet the OBD requirements of this section according to the phase-in schedule in paragraph (l) of this section. All monitored systems and components must be evaluated periodically, but no less frequently than once per applicable certification test cycle as defined in paragraphs (a) and (d) of Appendix I of this part.

(b) *Malfunction descriptions.* The OBD system must detect and identify malfunctions in all monitored emission-related powertrain systems or components according to the following malfunction definitions as measured and calculated in accordance with test procedures set forth in subpart B of this part (chassis-based test procedures), excluding those test procedures defined as ''Supplemental'' test procedures in § 86.004–2 and codified in §§ 86.158, 86.159, and 86.160.

(1) *Catalysts and particulate traps.* (i) *Otto-cycle.* Catalyst deterioration or malfunction before it results in an increase in NMHC emissions 1.5 times the NMHC standard or FEL, as compared to the NMHC emission level measured using a representative 4000 mile catalyst system.

(ii) *Diesel.* If equipped, catalyst or particulate trap deterioration or malfunction before it results in exhaust emissions exceeding 1.5 times the applicable standard or FEL for NO_X or PM. This monitoring need not be done if the manufacturer can demonstrate that deterioration or malfunction of the system will not result in exceedance of the threshold; however, the presence of the catalyst or particulate trap must still be monitored.

(2) *Engine misfire.* (i) *Otto-cycle.* Engine misfire resulting in exhaust emissions exceeding 1.5 times the applicable standard or FEL for NMHC, CO or NO_X; and any misfire capable of damaging the catalytic converter.

(ii) *Diesel.* Lack of cylinder combustion must be detected.

(3) *Oxygen sensors.* If equipped, oxygen sensor deterioration or malfunction resulting in exhaust emissions exceeding 1.5 times the applicable standard or FEL for NMHC, CO or NO_X.

(4) *Evaporative leaks.* If equipped, any vapor leak in the evaporative and/or refueling system (excluding the tubing and connections between the purge valve and the intake manifold) greater than or equal in magnitude to a leak caused by a 0.040 inch diameter orifice; an absence of evaporative purge air flow from the complete evaporative emission control system. On vehicles with fuel tank capacity greater than 25 gallons, the Administrator may, following a request from the manufacturer, revise the size of the orifice to the smallest orifice feasible, based on test data, if the most reliable monitoring method available cannot reliably detect a system leak equal to a 0.040 inch diameter orifice.

(5) *Other emission control systems.* Any deterioration or malfunction occurring in a powertrain system or component directly intended to control emissions, including but not necessarily limited to, the exhaust gas recirculation (EGR) system, if equipped, the secondary air system, if equipped, and the fuel control system, singularly resulting in exhaust emissions exceeding 1.5 times the applicable emission standard or FEL for NMHC, CO, NO_X, or diesel PM. For vehicles equipped with a secondary air system, a functional check, as described in paragraph (b)(6) of this section, may satisfy the requirements of this paragraph provided the manufacturer can demonstrate that deterioration of the flow distribution system is unlikely. This demonstration is subject to Administrator approval and, if the demonstration and associated functional check are approved, the diagnostic system must indicate a malfunction when some degree of secondary airflow is not detectable in the exhaust system during the check. For vehicles equipped with positive crankcase ventilation (PCV), monitoring of the PCV system is not necessary provided the manufacturer can demonstrate to the Administrator's satisfaction that the PCV system is unlikely to fail.

(6) *Other emission-related powertrain components.* Any other deterioration or malfunction occurring in an electronic emission-related powertrain system or component not otherwise described above that either provides input to or receives commands from the on-board computer and has a measurable impact on emissions; monitoring of components required by this paragraph must be satisfied by employing electrical circuit continuity checks and rationality checks for computer input components (input values within manufacturer specified ranges based on other available operating parameters), and functionality checks for computer output components (proper functional response to computer commands) except that the Administrator may waive such a rationality or functionality check where the manufacturer has demonstrated infeasibility. Malfunctions are defined as a failure of the system or component to meet the electrical circuit continuity checks or the rationality or functionality checks.

(7) *Performance of OBD functions.* Oxygen sensor or any other component deterioration or malfunction which renders that sensor or component incapable of performing its function as part of the OBD system must be detected and identified on vehicles so equipped.

(c) *Malfunction indicator light (MIL).* The OBD system must incorporate a malfunction indicator light (MIL) readily visible to the vehicle operator. When illuminated, the MIL must display ''Check Engine,'' ''Service Engine Soon,'' a universally recognizable engine symbol, or a similar phrase or symbol approved by the Administrator. A vehicle should not be equipped with more than one general purpose malfunction indicator light for emission-related problems; separate specific purpose warning lights (e.g. brake system, fasten seat belt, oil pressure, etc.) are permitted. The use of red for the OBD-related malfunction indicator light is prohibited.

(d) *MIL illumination.* The MIL must illuminate and remain illuminated when any of the conditions specified in paragraph (b) of this section are detected and verified, or whenever the engine control enters a default or secondary mode of operation considered abnormal for the given engine operating conditions. The MIL must blink once per second under any period of operation during which engine misfire is occurring and catalyst damage is imminent. If such misfire is detected again during the following driving cycle (i.e., operation consisting of, at a minimum, engine start-up and engine shut-off) or the next driving cycle in which similar conditions are encountered, the MIL must maintain a steady illumination when the misfire is not occurring and then remain illuminated until the MIL extinguishing criteria of this section are satisfied. The MIL must also illuminate when the vehicle's ignition is in the ''key-on'' position before engine starting or cranking and extinguish after engine starting if no malfunction has previously been detected. If a fuel system or engine misfire malfunction has previously been detected, the MIL may be extinguished if the malfunction does not reoccur during three subsequent sequential trips during which similar conditions are encountered and no new malfunctions have been detected. Similar conditions are defined as engine speed within 375 rpm, engine load within 20 percent, and engine warm-up status equivalent to that under which the malfunction was first detected. If any malfunction other than a fuel system or engine misfire malfunction has been detected, the MIL may be extinguished if the malfunction does not reoccur during three subsequent sequential trips during which the monitoring system responsible for illuminating the MIL functions without detecting the malfunction, and no new malfunctions have been detected. Upon Administrator approval, statistical MIL illumination protocols may be employed, provided they result in comparable timeliness in detecting a malfunction and evaluating system performance, i.e., three to six driving cycles would be considered acceptable.

(e) *Storing of computer codes.* The OBD system shall record and store in computer memory diagnostic trouble codes and diagnostic readiness codes indicating the status of the emission control system. These codes shall be available through the standardized data link connector per specifications as referenced in paragraph (h) of this section.

(1) A diagnostic trouble code must be stored for any detected and verified malfunction causing MIL illumination. The stored diagnostic trouble code must identify the malfunctioning system or component as uniquely as possible. At the manufacturer's discretion, a diagnostic trouble code may be stored for conditions not causing MIL illumination. Regardless, a separate code should be stored indicating the expected MIL illumination status (i.e., MIL commanded ''ON,'' MIL commanded ''OFF'').

(2) For a single misfiring cylinder, the diagnostic trouble code(s) must uniquely identify the cylinder, unless the manufacturer submits data and/or engineering evaluations which adequately demonstrate that the misfiring cylinder cannot be reliably identified under certain operating conditions. For diesel vehicles only, the specific cylinder for which combustion cannot be detected need not be identified if new hardware would be required to do so. The diagnostic trouble code must identify multiple misfiring cylinder conditions; under multiple misfire conditions, the misfiring cylinders need not be uniquely identified if a distinct multiple misfire diagnostic trouble code is stored.

(3) The diagnostic system may erase a diagnostic trouble code if the same code is not re-registered in at least 40 engine warm-up cycles, and the malfunction indicator light is not illuminated for that code.

(4) Separate status codes, or readiness codes, must be stored in computer memory to identify correctly functioning emission control systems and those emission control systems which require further vehicle operation to complete proper diagnostic evaluation. A readiness code need not be stored for those monitors that can be considered continuously operating monitors (e.g., misfire monitor, fuel system monitor, etc.). Readiness codes should never be set to ''not ready'' status upon key-on or key-off; intentional setting of readiness codes to ''not ready'' status via service procedures must apply to all such codes, rather than applying to individual codes. Subject to Administrator approval, if monitoring is disabled for a multiple number of driving cycles (i.e., more than one) due to the continued presence of extreme operating conditions (e.g., ambient temperatures below 40°F, or altitudes above 8000 feet), readiness for the subject monitoring system may be set to ''ready'' status without monitoring having been completed. Administrator approval shall be based on the conditions for monitoring system disablement, and the number of driving cycles specified without completion of monitoring before readiness is indicated.

(f) *Available diagnostic data.* (1) Upon determination of the first malfunction of any component or system, ''freeze frame'' engine conditions present at the time must be stored in computer memory. Should a subsequent fuel system or misfire malfunction occur, any previously stored freeze frame conditions must be replaced by the fuel system or misfire conditions (whichever occurs first). Stored engine conditions must include, but are not limited to: engine speed, open or closed loop operation, fuel system commands, coolant temperature, calculated load value, fuel pressure, vehicle speed, air flow rate, and intake manifold pressure if the information needed to determine these conditions is available to the computer. For freeze frame storage, the manufacturer must include the most appropriate set of conditions to facilitate effective repairs. If the diagnostic trouble code causing the conditions to be stored is erased in accordance with paragraph (d) of this section, the stored engine conditions may also be erased.

(2) The following data in addition to the required freeze frame information must be made available on demand through the serial port on the standardized data link connector, if the information is available to the on-board computer or can be determined using information available to the on-board computer: Diagnostic trouble codes, engine coolant temperature, fuel control system status (closed loop, open loop, other), fuel trim, ignition timing advance, intake air temperature, manifold air pressure, air flow rate, engine RPM, throttle position sensor output value, secondary air status (upstream, downstream, or atmosphere), calculated load value, vehicle speed, and fuel pressure. The signals must be provided in standard units based on SAE specifications incorporated by reference in paragraph (h) of this section. Actual signals must be clearly identified separately from default value or limp home signals.

(3) For all OBD systems for which specific on-board evaluation tests are conducted (catalyst, oxygen sensor, etc.), the results of the most recent test performed by the vehicle, and the limits to which the system is compared must be available through the standardized data link connector per the appropriate standardized specifications as referenced in paragraph (h) of this section.

(4) Access to the data required to be made available under this section shall be unrestricted and shall not require any access codes or devices that are only available from the manufacturer.

(g) *Exceptions.* The OBD system is not required to evaluate systems or components during malfunction conditions if such evaluation would result in a risk to safety or failure of systems or components. Additionally, the OBD system is not required to evaluate systems or components during operation of a power take-off unit such as a dump bed, snow plow blade, or aerial bucket, etc.

(h) *Reference materials.* The OBD system shall provide for standardized access and conform with the following Society of Automotive Engineers (SAE) standards and/or the following International Standards Organization (ISO) standards. The following documents are incorporated by reference (see § 86.1):

(1) *SAE material.* Copies of these materials may be obtained from the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096–0001.

(i) SAE J1850 ''Class B Data Communication Network Interface,'' (July 1995) shall be used as the on-board to off-board communications protocol. All emission related messages sent to the scan tool over a J1850 data link shall use the Cyclic Redundancy Check and the three byte header, and shall not use inter-byte separation or checksums.

(ii) Basic diagnostic data (as specified in §§ 86.094–17(e) and (f)) shall be provided in the format and units in SAE J1979 E/E Diagnostic Test Modes,''(July 1996).

(iii) Diagnostic trouble codes shall be consistent with SAE J2012 ''Recommended Practices for Diagnostic Trouble Code Definitions,'' (July 1996).

(iv) The connection interface between the OBD system and test equipment and diagnostic tools shall meet the functional requirements of SAE J1962 ''Diagnostic Connector,'' (January 1995).

(v) As an alternative to the above standards, heavy-duty vehicles may conform to the specifications of SAE J1939 ''Recommended Practice for a Serial Control and Communications Vehicle Network.''

(2) *ISO materials.* Copies of these materials may be obtained from the International Organization for Standardization, Case Postale 56, CH–1211 Geneva 20, Switzerland.

(i) ISO 9141–2 ''Road vehicles—Diagnostic systems—Part 2: CARB requirements for interchange of digital information,'' (February 1994) may be used as an alternative to SAE J1850 as the on-board to off-board communications protocol.

(ii) ISO 14230–4 ''Road vehicles—Diagnostic systems—KWP 2000 requirements for Emission-related systems'' may also be used as an alternative to SAE J1850.

(i) *Deficiencies and alternate fueled vehicles.* Upon application by the manufacturer, the Administrator may accept an OBD system as compliant even though specific requirements are not fully met. Such compliances without meeting specific requirements, or deficiencies, will be granted only if compliance would be infeasible or unreasonable considering such factors as, but not limited to: technical feasibility of the given monitor and lead time and production cycles including phase-in or phase-out of engines or vehicle designs and programmed upgrades of computers. Unmet requirements should not be carried over from the previous model year except where unreasonable hardware or software modifications would be necessary to correct the deficiency, and the manufacturer has demonstrated an acceptable level of effort toward compliance as determined by the Administrator. Furthermore, EPA will not accept any deficiency requests that include the complete lack of a major diagnostic monitor (''major'' diagnostic monitors being those for exhaust aftertreatment devices, oxygen sensor, engine misfire, evaporative leaks, and diesel EGR, if equipped), with the possible exception of the special provisions for alternate fueled vehicles. For alternate fueled vehicles (*e.g.* natural gas, liquefied petroleum gas, methanol, ethanol), beginning with the model year for which alternate fuel emission standards are applicable and extending through the 2004 model year, manufacturers may request the Administrator to waive specific monitoring requirements of this section for which monitoring may not be reliable with respect to the use of the alternate fuel; manufacturers may request this alternate fuel waiver for heavy-duty vehicles through the 2006 model year. At a minimum, alternate fuel vehicles must be equipped with an OBD system meeting OBD requirements to the extent feasible as approved by the Administrator.

(j) *California OBDII Compliance Option.* For light-duty vehicles, light-duty trucks, and heavy-duty vehicles at or below 14,000 pounds GVWR, demonstration of compliance with California OBD II requirements (Title 13 California Code Sec. 1968.1), as modified pursuant to California Mail Out #97–24 (December 9, 1997), shall satisfy the requirements of this section, except that the exemption to the catalyst monitoring provisions of California Code Sec. 1968.1(b)(1.1.2) for diesel vehicles does not apply, and compliance with California Code Secs. 1968.1(b)(4.2.2), pertaining to 0.02 inch evaporative leak detection, and 1968.1(d), pertaining to tampering protection, are not required to satisfy the requirements of this section. Also, the deficiency fine provisions of California Code Sec. 1968.1(m)(6.1) and (6.2) do not apply.

(k) *Certification.* For test groups required to have an OBD system, certification will not be granted if, for any test vehicle approved by the Administrator in consultation with the manufacturer, the malfunction indicator light does not illuminate under any of the following circumstances, unless the manufacturer can demonstrate that any identified OBD problems discovered during the Administrator's evaluation will be corrected on production vehicles.

(1)(i) *Otto-cycle.* A catalyst is replaced with a deteriorated or defective catalyst, or an electronic simulation of such, resulting in an increase of 1.5 times the NMHC standard or FEL above the NMHC emission level measured using a representative 4000 mile catalyst system.

(ii) *Diesel.* If monitored for emissions performance—a catalyst or particulate trap is replaced with a deteriorated or defective catalyst or trap, or an electronic simulation of such, resulting in exhaust emissions exceeding 1.5 times the applicable standard or FEL for NO_X or PM. If not monitored for emissions performance—removal of the catalyst or particulate trap is not detected and identified.

(2)(i) *Otto-cycle.* An engine misfire condition is induced resulting in exhaust emissions exceeding 1.5 times the applicable standards or FEL for NMHC, CO or NO_X.

(ii) *Diesel.* An engine misfire condition is induced and is not detected.

(3) If so equipped, any oxygen sensor is replaced with a deteriorated or defective oxygen sensor, or an electronic simulation of such, resulting in exhaust emissions exceeding 1.5 times the applicable standard or FEL for NMHC, CO or NO_X.

(4) If so equipped, a vapor leak is introduced in the evaporative and/or refueling system (excluding the tubing and connections between the purge valve and the intake manifold) greater than or equal in magnitude to a leak caused by a 0.040 inch diameter orifice, or the evaporative purge air flow is blocked or otherwise eliminated from the complete evaporative emission control system.

(5) A malfunction condition is induced in any emission-related powertrain system or component, including but not necessarily limited to, the exhaust gas recirculation (EGR) system, if equipped, the secondary air system, if equipped, and the fuel control system, singularly resulting in exhaust emissions exceeding 1.5 times the applicable emission standard or FEL for NMHC, CO, NO_X or PM.

(6) A malfunction condition is induced in an electronic emission-related powertrain system or component not otherwise described in this paragraph (k) that either provides input to or receives commands from the on-board computer resulting in a measurable impact on emissions.

(l) *Phase-in for Heavy-Duty Vehicles.* Manufacturers of heavy-duty vehicles intended for use in a heavy-duty vehicle weighing 14,000 pounds GVWR or less must comply with the OBD requirements in this section according to the following phase-in schedule, based on the percentage of projected vehicle sales within each category:

OBD COMPLIANCE PHASE-IN HEAVY-DUTY VEHICLES
[intended for use in a heavy-duty vehicle weighing 14,000 pounds GVWR or less]

Model year	Phase-in based on projected sales
2004 MY	—40% compliance
2005 MY	—60% compliance—alternative fuel waivers available
2006 MY	—80% compliance—alternative fuel waivers available
2007+ MY	—100% compliance—alternative fuel waivers available

44. Section 86.1807–01 is amended by adding paragraph (c)(3), and revising paragraphs (a)(3)(v), (d), (e), and (f), to read as follows:

§ 86.1807–01 Vehicle labeling.

(a) * * *

(3) * * *

(v) An unconditional statement of compliance with the appropriate model year U.S. EPA regulations which apply to light-duty vehicles, light-duty trucks, or complete heavy-duty vehicles;

* * * * *

(c) * * *

(3) The manufacturer of any complete heavy-duty vehicle subject to the emission standards of this subpart shall add the information required by paragraph (c)(1)(iii) of this section to the label required by paragraph (a) of this section. The required information will be set forth in the manner prescribed by paragraph (c)(1)(iii) of this section.

(d)(1) Incomplete light-duty trucks shall have the following prominent statement printed on the label required by paragraph (a)(3)(v) of this section: ‘‘This vehicle conforms to U.S. EPA regulations applicable to 20xx Model year Light-Duty Trucks under the special provisions of § 86.1801–01(c)(1) when it does not exceed XXX pounds in curb weight, XXX pounds in gross vehicle weight rating, and XXX square feet in frontal area.’’

(2) Incomplete heavy-duty vehicles optionally certified in accordance with the provisions for complete heavy-duty vehicles under the special provisions of § 86.1801–01(c)(2) shall have the following prominent statement printed on the label required by paragraph (a)(3)(v) of this section: ‘‘This vehicle conforms to U.S. EPA regulations applicable to 20xx Model year Complete Heavy-Duty Vehicles under the special provisions of § 86.1801–01(c)(2) when it does not exceed XXX pounds in curb weight, XXX pounds in gross vehicle weight rating, and XXX square feet in frontal area.’’

(e) The manufacturer of any incomplete light-duty vehicle, light-duty truck, or heavy-duty vehicle shall notify the purchaser of such vehicle of any curb weight, frontal area, or gross vehicle weight rating limitations affecting the emission certificate applicable to that vehicle. This notification shall be transmitted in a manner consistent with National Highway Safety Administration safety notification requirements published in 49 CFR part 568.

(f) All light-duty vehicles, light-duty trucks, and complete heavy-duty vehicles shall comply with SAE Recommended Practices J1877 ‘‘Recommended Practice for Bar-Coded Vehicle Identification Number Label,’’ (July 1994), and J1892 ‘‘Recommended Practice for Bar-Coded Vehicle Emission Configuration Label (May 1988). SAE J1877 and J1892 are incorporated by reference (see § 86.1).

* * * * *

45. Section 86.1809–01 is amended by revising paragraph (a), to read as follows:

§ 86.1809–01 Prohibition of defeat devices.

(a) No new light-duty vehicle, light-duty truck, or complete heavy-duty vehicle shall be equipped with a defeat device.

* * * * *

46. A new § 86.1810–04 is added to subpart S, to read as follows:

§ 86.1810–04 General standards; increase in emissions; unsafe conditions; waivers.

This section applies to model year 2004 and later light-duty vehicles, light-duty trucks, and complete heavy-duty vehicles fueled by gasoline, diesel, methanol, natural gas and liquefied petroleum gas fuels. Multi-fueled vehicles (including dual-fueled and flexible-fueled vehicles) shall comply with all requirements established for each consumed fuel (or blend of fuels in the case of flexible fueled vehicles). The standards of this subpart apply to both certification and in-use vehicles unless otherwise indicated. Section 86.1810–04 includes text that specifies requirements that differ from § 86.1810–01. Where a paragraph in § 86.1810–04 is identical and applicable to § 86.1810–01, this may be indicated by specifying the corresponding paragraph and the statement ‘‘[Reserved]. For guidance see § 86.1810–01.’’.

(a) through (c) [Reserved] For guidance see § 86.1810–01.

(d) *Crankcase emissions prohibited*. No crankcase emissions shall be discharged into the ambient atmosphere from any 2004 and later model year light-duty vehicle, light-duty truck, or complete heavy-duty vehicle.

(e) *On-board diagnostics.* All light-duty vehicles, light-duty trucks and complete heavy-duty vehicles must have an on-board diagnostic system as described in § 86.1806–04.

(f) through (i) [Reserved] For guidance see § 86.1810–01.

(j) *Evaporative emissions general provisions.* (1) The evaporative standards in §§ 86.1811–01(d), 86.1812–01(d), 86.1813–01(d), 86.1814–04(d), 86.1815–04(d) and 86.1816–04(d) apply equally to certification and in-use vehicles and trucks. The spitback standard also applies to newly assembled vehicles.

(2) For certification testing only, manufacturers may conduct testing to quantify a level of nonfuel background emissions for an individual test vehicle. Such a demonstration must include a description of the source(s) of emissions and an estimated decay rate. The demonstrated level of nonfuel background emissions may be subtracted from evaporative emission test results from certification vehicles if approved in advance by the Administrator.

(3) All fuel vapor generated in a gasoline-or methanol-fueled light-duty vehicle, light-duty truck, or complete heavy-duty vehicle during in-use operation shall be routed exclusively to the evaporative control system (e.g., either canister or engine purge.) The only exception to this requirement shall be for emergencies.

(k) *Refueling emissions general provisions.* (1) *Implementation schedules.* Table S04–5 of this section gives the minimum percentage of a manufacturer’s sales of the applicable model year’s gasoline- and methanol-fueled Otto-cycle and petroleum-fueled and methanol-fueled diesel-cycle heavy light-duty trucks and complete heavy-duty vehicles which shall be tested under the applicable procedures in subpart B of this part, and shall not exceed the standards described in §§ 86.1813–04(e), 86.1814–04(e), and

86.1816–04(e). Vehicles waived from the emission standards under the provisions of paragraphs (m) and (n) of this section shall not be counted in the calculation of the percentage of compliance. Either manufacturer sales or actual production intended for sale in the United States may be used to determine combined volume, at the manufacturers option. Table S04–5 follows:

TABLE S04–5—HEAVY LIGHT-DUTY TRUCKS AND COMPLETE HEAVY-DUTY VEHICLES

Model year	Percentage
2004	40
2005	80
2006	100

(2) *Determining sales percentages.* Sales percentages for the purposes of determining compliance with the applicable refueling emission standards for heavy light-duty trucks and complete heavy-duty vehicles shall be based on total actual U.S. sales of heavy light-duty trucks and complete heavy-duty vehicles of the applicable model year by a manufacturer to a dealer, distributor, fleet operator, broker, or any other entity which comprises the point of first sale.

(3) *Refueling receptacle requirements.* Refueling receptacles on natural gas-fueled light-duty vehicles, light-duty trucks, and complete heavy-duty vehicles shall comply with the receptacle provisions of the ANSI/AGA NGV1–1994 standard (as incorporated by reference in § 86.1(b)(3)). This requirement is subject to the phase-in schedules in Tables S01–3 and S01–4 in § 86.1810–01 (k)(1), and Table S04–5 in paragraph (k)(1) of this section.

(l) *Fuel dispensing spitback testing waiver.* (1) Vehicles certified to the refueling emission standards set forth in §§ 86.1811–01(e), 86.1812–01(e), 86.1813–01(e), 86.1814-04(e), 86.1815–04(e), and 86.1816–04(e) are not required to demonstrate compliance with the fuel dispensing spitback standard contained in that section provided that:

(i) The manufacturer certifies that the vehicle inherently meets the fuel dispensing spitback standard as part of compliance with the refueling emission standard; and

(ii) This certification is provided in writing and applies to the full useful life of the vehicle.

(2) EPA retains the authority to require testing to enforce compliance and to prevent noncompliance with the fuel dispensing spitback standard.

(m) *Inherently low refueling emission testing waiver.*

(1) Vehicles using fuels/fuel systems inherently low in refueling emissions are not required to conduct testing to demonstrate compliance with the refueling emission standards set forth in §§ 86.1811–01(e), 86.1812–01(e), 86.1813–01(e), 86.1814–04(e), and 86.1815–04(e), provided that:

(i) This provision is only available for petroleum diesel fuel. It is only available if the Reid Vapor Pressure of in-use diesel fuel is equal to or less than 1 psi (7 kPa) and for diesel vehicles whose fuel tank temperatures do not exceed 130 deg.F (54 deg. C); and

(ii) To certify using this provision the manufacturer must attest to the following evaluation: ‘‘Due to the low vapor pressure of diesel fuel and the vehicle tank temperatures, hydrocarbon vapor concentrations are low and the vehicle meets the 0.20 grams/gallon refueling emission standard without a control system.’’

(2) The certification required in paragraph (m)(1)(ii) of this section must be provided in writing and must apply for the full useful life of the vehicle.

(3) EPA reserves the authority to require testing to enforce compliance and to prevent noncompliance with the refueling emission standard.

(n) Fixed liquid level gauge waiver. Liquefied petroleum gas-fueled vehicles which contain fixed liquid level gauges or other gauges or valves which can be opened to release fuel or fuel vapor during refueling, and which are being tested for refueling emissions, are not required to be tested with such gauges or valves open, as outlined in § 86.157–98(d)(2), provided the manufacturer can demonstrate, to the satisfaction of the Administrator, that such gauges or valves would not be opened during refueling in-use due to inaccessibility or other design features that would prevent or make it very unlikely that such gauges or valves could be opened.

47. Section 86.1811–01 is amended by adding paragraph (h), to read as follows:

§ 86.1811–01 Emission standards for light-duty vehicles.

* * * * *

(g) Manufacturers may request to group light-duty vehicles into the same test group as vehicles subject to more stringent standards, so long as those light-duty vehicles meet the most stringent standards applicable to any vehicle within that test group, as provided at § 86.1827(a)(5) and (d)(4).

48. Section 86.1812–01 is amended by adding paragraph (h), to read as follows:

§ 86.1812–01 Emission standards for light-duty trucks 1.

* * * * *

(h) Manufacturers may request to group light-duty truck 1's into the same test group as vehicles subject to more stringent standards, so long as those light-duty truck 1's meet the most stringent standards applicable to any vehicle within that test group, as provided at § 86.1827(a)(5) and(d)(4).

49. Section 86.1813–01 is amended by adding paragraph (h), to read as follows:

§ 86.1813–01 Emission standards for light-duty trucks 2.

* * * * *

(h) Manufacturers may request to group light-duty truck 2's into the same test group as vehicles subject to more stringent standards, so long as those light-duty truck 2's meet the most stringent standards applicable to any vehicle within that test group, as provided at § 86.1827(a)(5) and (d)(4).

50. Section 86.1814–01 is amended by adding paragraph (h), to read as follows:

§ 86.1814–01 Emission standards for light-duty trucks 3.

* * * * *

(h) Manufacturers may request to group light-duty truck 3's into the same test group as vehicles subject to more stringent standards, so long as those light-duty truck 3's meet the most stringent standards applicable to any vehicle within that test group, as provided at § 86.1827(a)(5) and (d)(4).

51. Section 86.1814–02 is amended by adding paragraph (h), to read as follows:

§ 86.1814–02 Emission standards for light-duty trucks 3.

* * * * *

(h) Manufacturers may request to group light-duty truck 3's into the same test group as vehicles subject to more stringent standards, so long as those light-duty truck 3's meet the most stringent standards applicable to any vehicle within that test group, as provided at § 86.1827(a)(5) and (d)(4).

52. Section 86.1815–01 is amended by adding paragraph (h), to read as follows:

§ 86.1815–01 Emission standards for light-duty trucks 4.

* * * * *

(h) Manufacturers may request to group light-duty truck 4's into the same test group as vehicles subject to more stringent standards, so long as those light-duty truck 4's meet the most stringent standards applicable to any vehicle within that test group, as provided at § 86.1827(a)(5) and (d)(4).

53. Section 86.1815–02 is amended by adding paragraph (h), to read as follows:

§ 86.1815–02 Emission standards for light-duty trucks 4.

* * * * *

(h) Manufacturers may request to group light-duty truck 4's into the same test group as vehicles subject to more stringent standards, so long as those light-duty truck 4's meet the most stringent standards applicable to any vehicle within that test group, as provided at § 86.1827(a)(5) and (d)(4).

54. A new section 86.1816–04 is added to subpart S, to read as follows:

§ 86.1816–04 Emission standards for complete heavy-duty vehicles

This section applies to 2004 and later model year complete heavy-duty vehicles fueled by gasoline, methanol, natural gas and liquefied petroleum gas fuels except as noted. This section also applies to 2000 and later model year complete heavy duty vehicles participating in the early banking provisions of the averaging, trading and banking program as specified in § 86.1817–04(n). Multi-fueled vehicles shall comply with all requirements established for each consumed fuel. For methanol fueled vehicles, references in this section to hydrocarbons or total hydrocarbons shall mean total hydrocarbon equivalents and references to non-methane hydrocarbons shall mean non-methane hydrocarbon equivalents.

(a) *Exhaust emission standards.* (1) Exhaust emissions from 2004 and later model year complete heavy-duty vehicles at and above 8,500 pounds Gross Vehicle Weight Rating but equal to or less than 10,000 Gross Vehicle Weight Rating pounds shall not exceed the following standards at full useful life:

(i) [Reserved]

(ii) *Non-methane organic gas.* 0.280 grams per mile; this requirement may be satisfied by measurement of non-methane hydrocarbons or total hydrocarbons, at the manufacturer's option.

(iii) *Carbon monoxide.* 7.3 grams per mile.

(iv) *Oxides of nitrogen.* 0.9 grams per mile.

(v) [Reserved]

(2) Exhaust emissions from 2004 and later model year complete heavy-duty vehicles above 10,000 pounds Gross Vehicle Weight Rating but less than 14,000 pounds Gross Vehicle Weight Rating shall not exceed the following standards at full useful life:

(i) [Reserved]

(ii) *Non-methane organic gas.* 0.330 grams per mile; this requirement may be satisfied by measurement of non-methane hydrocarbons or total hydrocarbons, at the manufacturer's option.

(iii) *Carbon monoxide.* 8.1 grams per mile.

(iv) *Oxides of nitrogen.* 1.0 grams per mile.

(v) [Reserved]

(b) [Reserved]

(c) [Reserved]

(d) *Evaporative emissions.* Evaporative hydrocarbon emissions from gasoline-fueled, natural gas-fueled, liquefied petroleum gas-fueled, and methanol-fueled complete heavy-duty vehicles shall not exceed the following standards. The standards apply equally to certification and in-use vehicles. The spitback standard also applies to newly assembled vehicles.

(1) For the full three-diurnal test sequence, diurnal plus hot soak measurements: 3.0 grams per test.

(2) *Gasoline and methanol fuel only.* For the supplemental two-diurnal test sequence, diurnal plus hot soak measurements: 3.5 grams per test.

(3) *Gasoline and methanol fuel only.* Running loss test: 0.05 grams per mile.

(4) *Gasoline and methanol fuel only.* Fuel dispensing spitback test: 1.0 grams per test.

(e) *Refueling emissions.* (1) Refueling emissions from complete heavy-duty vehicles equal to or less than 10,000 pounds Gross Vehicle Weight Rating shall be phased in, in accordance with the schedule in Table S04–5 in § 1810–04 not to exceed the following emission standards:

(i) For gasoline-fueled and methanol-fueled vehicles: 0.20 grams hydrocarbon per gallon (0.053 gram per liter) of fuel dispensed.

(ii) For liquefied petroleum gas-fueled vehicles: 0.15 grams hydrocarbon per gallon (0.04 gram per liter) of fuel dispensed.

(2) The provisions of § 86.1816–04(e) do not apply to incomplete heavy-duty vehicles optionally certified to complete heavy duty vehicle standards under the provisions of § 86.1801–01(c)(2).

(f) [Reserved]

(g) *Idle exhaust emission standards, complete heavy-duty vehicles.* Exhaust emissions of carbon monoxide from 2004 and later model year gasoline, methanol, natural gas- and liquefied petroleum gas-fueled complete heavy-duty vehicles shall not exceed 0.50 percent of exhaust gas flow at curb idle for a useful life of 11 years or 120,000 miles, whichever occurs first.

(h) Manufacturers may request to group complete heavy-duty vehicles into the same test group as vehicles subject to more stringent standards, so long as those complete heavy-duty vehicles meet the most stringent standards applicable to any vehicle within that test group, as provided at § 86.1827(a)(5) and (d)(4).

55. A new section 86.1817–04 is added to subpart S, to read as follows:

§ 86.1817–04 Complete heavy-duty vehicle averaging, trading, and banking program.

(a)(1) Complete heavy-duty vehicles eligible for the NO_X averaging, trading and banking program are described in the applicable emission standards section of this subpart. All heavy-duty vehicles which include an engine labeled for use in clean-fuel vehicles as specified in 40 CFR part 88 are not eligible for this program. Participation in this averaging, trading, and banking program is voluntary.

(2)(i) Test groups with a family emission limit (FEL) as defined in § 86.1803–01 exceeding the applicable standard shall obtain emission credits as defined in § 86.1803–01 in a mass amount sufficient to address the shortfall. Credits may be obtained from averaging, trading, or banking, as defined in § 86.1803–01 within the averaging set restrictions described in paragraph (d) of this section.

(ii) Test groups with an FEL below the applicable standard will have emission credits available to average, trade, bank or a combination thereof. Credits may not be used for averaging or trading to offset emissions that exceed an FEL. Credits may not be used to remedy an in-use nonconformity determined by a Selective Enforcement Audit or by recall testing. However, credits may be used to allow subsequent production of vehicles for the test group in question if the manufacturer elects to recertify to a higher FEL.

(b) Participation in the NO_X averaging, trading, and banking program shall be done as follows:

(1) During certification, the manufacturer shall:

(i) Declare its intent to include specific test groups in the averaging, trading and banking program.

(ii) Declare an FEL for each test group participating in the program.

(A) The FEL must be to the same level of significant digits as the emission standard (one-hundredth of a gram per mile for NO_X emissions).

(B) In no case may the FEL exceed the upper limit prescribed in the section concerning the applicable complete heavy-duty vehicle chassis-based NO_X emission standard.

(iii) Calculate the projected NO_X emission credits (positive or negative) as defined in § 86.1803–01 based on quarterly production projections for each participating test group, using the applicable equation in paragraph (c) of this section and the applicable factors for the specific test group.

(iv)(A) Determine and state the source of the needed credits according to quarterly projected production for test groups requiring credits for certification.

(B) State where the quarterly projected credits will be applied for test groups generating credits.

(C) Emission credits as defined in § 86.1803–01 may be obtained from or applied to only test groups within the same averaging set as defined in § 86.1803–01. Emission credits available for averaging, trading, or banking, may be applied exclusively to a given test group, or designated as reserved credits as defined in § 86.1803–01.

(2) Based on this information, each manufacturer's certification application must demonstrate:

(i) That at the end of model year production, each test group has a net emissions credit balance of zero or more using the methodology in paragraph (c) of this section with any credits obtained from averaging, trading or banking.

(ii) The source of the credits to be used to comply with the emission standard if the FEL exceeds the standard, or where credits will be applied if the FEL is less than the emission standard. In cases where credits are being obtained, each test group involved must state specifically the source (manufacturer/test group) of the credits being used. In cases where credits are being generated/supplied, each test group involved must state specifically the designated use (manufacturer/test group or reserved) of the credits involved. All such reports shall include all credits involved in averaging, trading or banking.

(3) During the model year, manufacturers must:

(i) Monitor projected versus actual production to be certain that compliance with the emission standards is achieved at the end of the model year.

(ii) Provide the end-of-year reports required under paragraph (i) of this section.

(iii) For manufacturers participating in emission credit trading, maintain the quarterly records required under paragraph (l) of this section.

(4) Projected credits based on information supplied in the certification application may be used to obtain a certificate of conformity. However, any such credits may be revoked based on review of end-of-model year reports, follow-up audits, and any other compliance measures deemed appropriate by the Administrator.

(5) Compliance under averaging, banking, and trading will be determined at the end of the model year. Test groups without an adequate amount of NO_X emission credits will violate the conditions of the certificate of conformity. The certificates of conformity may be voided ab initio for test groups exceeding the emission standard.

(6) If EPA or the manufacturer determines that a reporting error occurred on an end-of-year report previously submitted to EPA under this section, the manufacturer's credits and credit calculations will be recalculated. Erroneous positive credits will be void. Erroneous negative balances may be adjusted by EPA for retroactive use.

(i) If EPA review of a manufacturer's end-of-year report indicates a credit shortfall, the manufacturer will be permitted to purchase the necessary credits to bring the credit balance for that test group to zero, at the ratio of 1.2 credits purchased for every credit needed to bring the balance to zero. If sufficient credits are not available to bring the credit balance for the test group in question to zero, EPA may void the certificate for that test group ab initio.

(ii) If within 180 days of receipt of the manufacturer's end-of-year report, EPA review determines a reporting error in the manufacturer's favor (*i.e.* resulting in a positive credit balance) or if the manufacturer discovers such an error within 180 days of EPA receipt of the end-of-year report, the credits will be restored for use by the manufacturer.

(c) For each participating test group, NO_X emission credits (positive or negative) are to be calculated according to one of the following equations and rounded, in accordance with ASTM E29–93a, to the nearest one-tenth of a Megagram (MG). Consistent units are to be used throughout the equation.

(1) For determining credit need for all test groups and credit availability for test groups generating credits for averaging only:

$$\text{Emission credits} = (\text{Std} - \text{FEL}) \times (\text{UL}) \times (\text{Production}) \times (10^{-6})$$

(2) For determining credit availability for test groups generating credits for trading or banking:

$$\text{Emission credits} = (\text{Std} - \text{FEL}) \times (\text{UL}) \times (\text{Production}) \times (10^{-6}) (\text{Discount})$$

(3) For purposes of the equations in paragraphs (c)(1) and (c)(2) of this section:

Std=the current and applicable complete heavy-duty vehicle NO_X emission standard in grams per mile or grams per kilometer for model year 2004 and later vehicles.

Std=0.9 grams per mile for model year 2001 through 2003 heavy-duty vehicles at and above 8,500 pounds Gross Vehicle Weight Rating but equal to or less than 10,000 Gross Vehicle Weight Rating pounds and 1.0 grams per mile for heavy-duty vehicles above 10,000 pounds Gross Vehicle Weight Rating but less than 14,000 pounds Gross Vehicle Weight Rating.

FEL=the NO_X family emission limit for the test group in grams per mile or grams per kilometer.

UL=the useful life, or alternative life as described in paragraph (c) of § 86.1805–01, for the given test group in miles or kilometers.

Production=the number of vehicles produced for U.S. sales within the given test group during the model year. Quarterly production projections are used for initial certification. Actual production is used for end-of-year compliance determination.

Discount=a one-time discount applied to all credits to be banked or traded within the model year generated. Except as otherwise allowed in paragraph (m) of this section, the discount applied here is 0.9. Banked credits traded in a subsequent model year will not be subject to an additional discount. Banked credits used in a subsequent model year's averaging program will not have the discount restored.

(d) *Averaging sets.* The averaging and trading of NO_X emission credits will be allowed between all test groups of complete heavy-duty vehicle excluding those vehicles produced for sale in California. Averaging, banking, and trading are not applicable to vehicles sold in California.

(e) *Banking of NO_X emission credits.* (1) *Credit deposits.* (i) NO_X emission credits may be banked from test groups produced in any model year.

(ii) Manufacturers may bank credits only after the end of the model year and after actual credits have been reported to EPA in the end-of-year report. During the model year and before submittal of the end-of-year report, credits originally designated in the certification process for banking will be considered reserved and may be redesignated for trading or averaging.

(2) *Credit withdrawals.* (i) NO_X credits generated in 2004 and later model years do not expire.

(ii) Manufacturers withdrawing banked emission credits shall indicate so during certification and in their credit reports, as described in paragraph (i) of this section.

(3) *Use of banked emission credits.* The use of banked credits shall be

within the averaging set and geographic restrictions described in paragraph (d) of this section, and only for the following purposes:

(i) Banked credits may be used in averaging, or in trading, or in any combination thereof, during the certification period. Credits declared for banking from the previous model year but not reported to EPA may also be used. However, if EPA finds that the reported credits can not be proven, they will be revoked and unavailable for use.

(ii) Banked credits may not be used for averaging and trading to offset emissions that exceed an FEL. Banked credits may not be used to remedy an in-use nonconformity determined by a Selective Enforcement Audit or by recall testing. However, banked credits may be used for subsequent production of the test group if the manufacturer elects to recertify to a higher FEL.

(f) In the event of a negative credit balance in a trading situation, both the buyer and the seller would be liable.

(g) Certification fuel used for credit generation must be of a type that is both available in use and expected to be used by the vehicle purchaser. Therefore, upon request by the Administrator, the vehicle manufacturer must provide information acceptable to the Administrator that the designated fuel is readily available commercially and would be used in customer service.

(h) *Credit apportionment.* At the manufacturers option, credits generated from complete heavy-duty vehicles under the provisions described in this section may be sold to or otherwise provided to the another party for use in programs other than the averaging, trading and banking program described in this section.

(1) The manufacturer shall pre-identify two emission levels per test group for the purposes of credit apportionment. One emission level shall be the FEL and the other shall be the level of the standard that the test group is required to certify to under § 86.1816–04. For each test group, the manufacturer may report vehicle sales in two categories, ''ABT-only credits'' and ''nonmanufacturer-owned credits''.

(i) For vehicle sales reported as ''ABT-only credits'', the credits generated must be used solely in the averaging, trading and banking program described in this section.

(ii) The vehicle manufacturer may declare a portion of vehicle sales ''nonmanufacturer-owned credits'' and this portion of the credits generated between the standard and the FEL, based on the calculation in paragraph (c)(1) of this section, would belong to the vehicle purchaser. The manufacturer may not generate any credits for the vehicle sales reported as ''nonmanufacturer-owned credits'' for this averaging, trading and banking program. Vehicles reported as ''nonmanufacturer-owned credits'' shall comply with the FEL and the requirements of this averaging, trading and banking program in all other respects.

(2) Only manufacturer-owned credits reported as ''ABT-only credits'' shall be used in the averaging, trading, and banking provisions described in this section.

(3) Credits shall not be double-counted. Credits used in this averaging, trading and banking program may not be provided to a vehicle purchaser for use in another program.

(4) Manufacturers shall determine and state the number of vehicles sold as ''ABT-only credits'' and ''nonmanufacturer-owned credits'' in the end-of-model year reports required under paragraph (i) of this section.

(i) Manufacturers participating in the emissions averaging, trading and banking program, shall submit for each participating test group the items listed in paragraphs (i)(1) through (3) of this section.

(1) *Application for certification.* (i) The application for certification will include a statement that the vehicles for which certification is requested will not, to the best of the manufacturer's belief, when included in the averaging, trading and banking program, cause the applicable NO_X emissions standard to be exceeded.

(ii) The application for certification will also include identification of the section of this subpart under which the test group is participating in the averaging, trading and banking program (e.g., § 86.1817–04), the type (NO_X), and the projected number of credits generated/needed for this test group, the applicable averaging set, the projected U.S. production volumes (excluding vehicles produced for sale in California), by quarter, and the values required to calculate credits as given in the applicable averaging, trading and banking section. Manufacturers shall also submit how and where credit surpluses are to be dispersed and how and through what means credit deficits are to be met, as explained in the applicable averaging, trading and banking section. The application must project that each test group will be in compliance with the applicable emission standards based on the vehicle mass emissions and credits from averaging, trading and banking.

(2) [Reserved].

(3) *End-of-year report.* The manufacturer shall submit end-of-year reports for each test group participating in the averaging, trading and banking program, as described in paragraphs (i)(3)(i) through (iv) of this section.

(i) These reports shall be submitted within 90 days of the end of the model year to: Director, Engine Programs and Compliance Division (6405J), U.S. Environmental Protection Agency, 401 M Street, SW, Washington, DC 20460.

(ii) These reports shall indicate the test group, the averaging set, the actual U.S. production volume (excluding vehicles produced for sale in California), the values required to calculate credits as given in the applicable averaging, trading and banking section, and the resulting type and number of credits generated/required. Manufacturers shall also submit how and where credit surpluses were dispersed (or are to be banked) and how and through what means credit deficits were met. Copies of contracts related to credit trading must also be included or supplied by the broker if applicable. The report shall also include a calculation of credit balances to show that net mass emissions balances are within those allowed by the emission standards (equal to or greater than a zero credit balance). Any credit discount factor described in the applicable averaging, trading and banking section must be included as required.

(iii) The production counts for end-of-year reports shall be based on the location of the first point of retail sale (e.g., customer, dealer, secondary manufacturer) by the manufacturer.

(iv) Errors discovered by EPA or the manufacturer in the end-of-year report, including changes in the production counts, may be corrected up to 180 days subsequent to submission of the end-of-year report. Errors discovered by EPA after 180 days shall be corrected if credits are reduced. Errors in the manufacturer's favor will not be corrected if discovered after the 180 day correction period allowed.

(j) Failure by a manufacturer participating in the averaging, trading and banking program to submit any quarterly or end-of-year report (as applicable) in the specified time for all vehicles that are part of an averaging set is a violation of section 203(a)(1) of the Clean Air Act (42 U.S.C. 7522(a)(1)) for such vehicles.

(k) Failure by a manufacturer generating credits for deposit only in the complete heavy-duty vehicle banking program to submit their end-of-year reports in the applicable specified time period (i.e., 90 days after the end of the model year) shall result in the credits not being available for use until such reports are received and reviewed by EPA. Use of projected credits pending EPA review will not be permitted in these circumstances.

(l) Any manufacturer producing a test group participating in trading using reserved credits, shall maintain the following records on a quarterly basis for each test group in the trading subclass:

(1) The test group;
(2) The averaging set;
(3) The actual quarterly and cumulative U.S. production volumes excluding vehicles produced for sale in California;
(4) The values required to calculate credits as given in paragraph (c) of this section;
(5) The resulting type and number of credits generated/required;
(6) How and where credit surpluses are dispersed; and
(7) How and through what means credit deficits are met.

(m) *Additional flexibility for complete heavy-duty vehicles.* If a complete heavy-duty vehicle has a NO_X FEL of 0.6 grams per mile or lower, a discount of 1.0 may be used in the trading and banking credits calculation for NO_X described in paragraph (c)(2) of this section.

(n) *Early banking for complete heavy-duty vehicles.* Provisions set forth in paragraphs (a) through (m) of this section apply except as specifically stated otherwise in paragraph (n) of this section.

(1) To be eligible for the early banking program described in this paragraph, the following must apply:

(i) Credits are generated from complete heavy-duty vehicles.

(ii) During certification, the manufacturer shall declare its intent to include specific test groups in the early banking program described in this paragraph.

(2) *Credit generation and use.* (i) Credits shall only be generated by model year 2000 through 2003 test groups.

(ii) Credits may only be used for 2004 and later model year complete heavy-duty vehicles and shall be subject to all discounting, credit life, and all other provisions contained in paragraphs (a) through (m) of this section.

56. Section 86.1821–01 is amended by revising the first sentence of paragraph (a), and the introductory text of paragraph (b), to read as follows:

§ 86.1821–01 Evaporative/refueling family determination.

(a) The gasoline-, methanol-, liquefied petroleum gas-, and natural gas-fueled light-duty vehicles, light-duty trucks, and complete heavy-duty vehicles described in a certification application will be divided into groupings which are expected to have similar evaporative and/or refueling emission characteristics (as applicable) throughout their useful life. * * *

(b) For gasoline-fueled or methanol-fueled light-duty vehicles, light-duty trucks, and complete heavy-duty vehicles to be classed in the same evaporative/refueling family, vehicles must be similar with respect to the items listed in paragraphs (b)(1) through (9) of this section.

* * * * *

57. Section 86.1823–01 is amended by revising the introductory text, paragraph (c)(2) introductory text, and the first sentence of paragraph (h), to read as follows:

§ 86.1823–01 Durability demonstration procedures for exhaust emissions.

This section applies to light-duty vehicles, light-duty trucks, complete heavy-duty vehicles, and heavy-duty vehicles certified under the provisions of § 86.1801–01(c). Eligible small volume manufacturers or small volume test groups may optionally meet the requirements of §§ 86.1838–01 and 86.1826–01 in lieu of the requirements of this section. For model years 2001, 2002, and 2003 all manufacturers may elect to meet the provisions of paragraph (c)(2) of this section in lieu of these requirements for light-duty vehicles or light-duty trucks.

* * * * *

(c) * * *

(2) For the 2001, 2002, and 2003 model years, for light-duty vehicles and light-duty trucks the manufacturer may carry over exhaust emission DF's previously generated under the Standard AMA Durability Program described in § 86.094–13(c), the Alternate Service Accumulation Durability Program described in § 86.094–13(e) or the Standard Self-Approval Durability Program for light-duty trucks described in § 86.094–13(f) in lieu of complying with the durability provisions of paragraph (a)(1) of this section.

* * * * *

(h) The Administrator may withdraw approval to use a durability process or require modifications to a durability process based on the data collected under §§ 86.1845–01, 86.1846–01, and 86.1847–01 or other information if the Administrator determines that the durability processes have not been shown to accurately predict emission levels or compliance with the standards (or FEL, as applicable) in use on candidate vehicles (provided the inaccuracy could result in a lack of compliance with the standards for a test group covered by this durability process). * * *

* * * * *

58. Section 86.1824–01 is amended by revising the first sentence of the introductory text, redesignating paragraphs (d) through (f) as paragraphs (e) through (g), and by adding new paragraph (d), to read as follows:

§ 86.1824–01 Durability demonstration procedures for evaporative emissions.

This section applies to gasoline-, methanol-, liquefied petroleum gas-, and natural gas-fueled light-duty vehicles, light-duty trucks, complete heavy-duty vehicles, and heavy-duty vehicles certified under the provisions of § 86.1801–01(c). * * *

* * * * *

(d) The durability process described in paragraph (a) of this section must be described in the application for certification under the provisions of § 86.1844–01.

* * * * *

59. Section 86.1825–01 is amended by revising the first two sentences of introductory text to read as follows:

§ 86.1825–01 Durability demonstration procedures for refueling emissions.

This section applies to light-duty vehicles, light-duty trucks, and complete heavy-duty vehicles, and heavy-duty vehicles which are certified under light-duty rules as allowed under the provisions of § 86.1801–01(c) which are subject to refueling loss emission compliance. Refer to the provisions of §§ 86.1811–01, 86.1812–01, 86.1813–01, 86.1814–04, 86.1815–04, and 86.1816–04 to determine applicability of the refueling standards to different classes of vehicles for various model years. * * *

* * * * *

60. Section 86.1826–01 is amended by revising paragraphs (b)(2) introductory text and (b)(3) introductory text, to read as follows:

§ 86.1826–01 Assigned deterioration factors for small volume manufacturers and small volume test groups.

* * * * *

(b) * * *

(2) Manufacturers with aggregated sales from and including 301 through 14,999 motor vehicles and motor vehicle engines per year (determined under the provisions of § 86.1838–01(b)) certifying vehicles equipped with

proven emission control systems shall conform to the following provisions:

* * * * *

(3) Manufacturers with aggregated sales from 301 through 14,999 motor vehicles and motor vehicle engines per year (determined under the provisions of § 86.1838–01(b)) certifying vehicles equipped with unproven emission control systems shall conform to the following provisions:

* * * * *

61. Section 86.1827–01 is amended by revising paragraph (a)(5), removing ''and'' at the end of paragraph (d)(2), removing the period at the end of paragraph (d)(3) and adding ''; and'' in its place, and adding paragraph (d)(4), to read as follows:

§ 86.1827–01 Test group determination.

* * * * *

(a) * * *

(5) Subject to the same emission standards, except that a manufacturer may request to group vehicles into the same test group as vehicles subject to more stringent standards, so long as those all the vehicles within the test group are certified to the most stringent standards applicable to any vehicle within that test group. Light-duty trucks which are subject to the same emission standards as light-duty vehicles with the exception of the light-duty truck idle CO standard and/or total HC standard may be included in the same test group.

* * * * *

(d) * * *

(4) A statement that all vehicles within a test group are certified to the most stringent standards applicable to any vehicle within that test group.

62. Section 86.1829–01 is amended by revising paragraphs (b)(1)(ii)(B), (b)(2)(ii)(B), and (b)(5), to read as follows:

§ 86.1829–01 Durability and emission testing requirements; waivers.

* * * * *

(b) * * *

(1) * * *

(ii) * * *

(B) In lieu of testing vehicles according to the provisions of paragraph (b)(1)(ii)(A) of this section, a manufacturer may provide a statement in its application for certification that, based on the manufacturer's engineering evaluation of appropriate high-altitude emission testing, all light-duty vehicles, light-duty trucks, and complete heavy-duty vehicles comply with the emission standards at high altitude.

* * * * *

(2) * * *

(ii) * * *

(B) In lieu of testing vehicles according to the provisions of paragraph (b)(2)(ii)(A) of this section, a manufacturer may provide a statement in its application for certification that, based on the manufacturer's engineering evaluation of such high-altitude emission testing as the manufacturer deems appropriate, all light-duty vehicles, light-duty trucks, and complete heavy-duty vehicles comply with the emission standards at high altitude.

* * * * *

(5) *Idle CO Testing.* To determine idle CO emission compliance for light-duty trucks and complete heavy-duty vehicles, the manufacturer shall follow one of the following two procedures:

(i) For test groups containing light-duty trucks and complete heavy-duty vehicles, each EDV shall be tested in accordance with the idle CO testing procedures of subpart B of this Part; or

(ii) In lieu of testing light trucks and complete heavy-duty vehicles for idle CO emissions, a manufacturer may provide a statement in its application for certification that, based on the manufacturer's engineering evaluation of such idle CO testing as the manufacturer deems appropriate, all light-duty trucks and complete heavy-duty vehicles comply with the idle CO emission standards.

* * * * *

63. Section 86.1834–01 is amended by redesignating paragraphs (b)(3)(i), (b)(5) and (b)(6) as paragraphs (b)(3)(i)(A), (b)(6) and (b)(7), respectively, revising paragraphs (b)(3) introductory text, (b)(3)(ii) introductory text, (b)(3)(iii), (b)(3)(iv), the first sentence of newly redesignated paragraph (b)(6)(iii), the seventh sentence of newly redesignated paragraph (b)(7)(ii), the first sentence of newly redesignated paragraph (b)(7)(iii), and the heading of paragraph (d), adding paragraphs (b)(3)(i)(B), (b)(3)(v), (b)(3)(vi), and (b)(6)(i)(H), and adding and reserving paragraph (b)(5), to read as follows:

§ 86.1834–01 Allowable maintenance.

* * * * *

(b) * * *

(3) Emission-related maintenance in addition to, or at shorter intervals than, that listed in paragraphs (b)(3)(i) through (vi) of this section will not be accepted as technologically necessary, except as provided in paragraph (b)(7) of this section.

(i) * * *

(B) The cleaning or replacement of complete heavy-duty vehicle spark plugs shall occur at 25,000 miles (or 750 hours) of use and at 30,000-mile (or 750 hour) intervals thereafter, for vehicles certified for use with unleaded fuel only.

(ii) For light-duty vehicles and light-duty trucks, the adjustment, cleaning, repair, or replacement of the following items shall occur at 50,000 miles of use and at 50,000-mile intervals thereafter:

* * * * *

(iii) For complete heavy-duty vehicles, the adjustment, cleaning, repair, or replacement of the following items shall occur at 50,000 miles (or 1,500 hours) of use and at 50,000-mile (1,500 hour) intervals thereafter:

(A) Positive crankcase ventilation valve.

(B) Emission-related hoses and tubes.

(C) Ignition wires.

(D) Idle mixture.

(E) Exhaust gas recirculation system related filters and coolers.

(iv) For light-duty trucks, light-duty vehicles, and complete heavy-duty vehicles, the adjustment, cleaning, repair, or replacement of the oxygen sensor shall occur at 80,000 miles (or 2,400 hours) of use and at 80,000-mile (or 2,400-hour) intervals thereafter.

(v) For light-duty trucks and light-duty vehicles, the adjustment, cleaning, repair, or replacement of the following items shall occur at 100,000 miles of use and at 100,000-mile intervals thereafter:

(A) Catalytic converter.

(B) Air injection system components.

(C) Fuel injectors.

(D) Electronic engine control unit and its associated sensors (except oxygen sensor) and actuators.

(E) Evaporative and/or refueling emission canister(s).

(F) Turbochargers.

(G) Carburetors.

(H) Superchargers.

(I) Exhaust gas recirculation system including all related filters and control valves.

(vi) For complete heavy-duty vehicles, the adjustment, cleaning, repair, or replacement of the following items shall occur at 100,000 miles (or 3,000 hours) of use and at 100,000-mile (or 3,000 hour) intervals thereafter:

(A) Catalytic converter.

(B) Air injection system components.

(C) Fuel injectors.

(D) Electronic engine control unit and its associated sensors (except oxygen sensor) and actuators.

(E) Evaporative and/or refueling emission canister(s).

(F) Turbochargers.

(G) Carburetors.

(H) Exhaust gas recirculation system (including all related control valves and tubing) except as otherwise provided in paragraph (b)(3)(iii)(E) of this section.

* * * * *

(5) [Reserved]

(6) * * *

(i) * * *

(H) Any other add-on emissions-related component (i.e., a component whose sole or primary purpose is to reduce emissions or whose failure will significantly degrade emissions control and whose function is not integral to the design and performance of the engine.)

(iii) Visible signal systems used under paragraph (b)(6)(ii)(C) of this section are considered an element of design of the emission control system. * * *

(7) * * *

(ii) * * * For maintenance items established as emission-related, the Administrator will further designate the maintenance as critical if the component which receives the maintenance is a critical component under paragraph (b)(6) of this section. * * *

(iii) Any manufacturer may request a hearing on the Administrator's determinations in this paragraph (b)(7). * * *

(d) *Unscheduled maintenance on durability data vehicles.* * * *

* * * * *

64. Section 86.1835–01 is amended by revising the third sentence of paragraph (a)(1)(i), paragraph (b)(1) introductory text, and paragraph (b)(3) introductory text, to read as follows:

§ 86.1835–01 Confirmatory certification testing.

(a) * * *

(1) * * *

(i) * * * The Administrator, in making or specifying such adjustments, will consider the effect of the deviation from the manufacturer's recommended setting on emissions performance characteristics as well as the likelihood that similar settings will occur on in-use light-duty vehicles, light-duty trucks, or complete heavy-duty vehicles. * * *

* * * * *

(b) * * * (1) If the Administrator determines not to conduct a confirmatory test under the provisions of paragraph (a) of this section, light-duty vehicle and light-duty truck manufacturers will conduct a confirmatory test at their facility after submitting the original test data to the Administrator whenever any of the conditions listed in paragraph (b)(1)(i) through (v) of this section exist, and complete heavy-duty vehicles manufacturers will conduct a confirmatory test at their facility after submitting the original test data to the Administrator whenever the conditions listed in paragraph (b)(1)(i) or (b)(1)(ii) of this section exist.

* * * * *

(3) For light-duty vehicles, and light-duty trucks, the manufacturer shall conduct a retest of the FTP or highway test if the difference between the fuel economy of the confirmatory test and the original manufacturer's test equals or exceeds three percent (or such lower percentage to be applied consistently to all manufacturer conducted confirmatory testing as requested by the manufacturer and approved by the Administrator).

* * * * *

65. Section 86.1840–01 is revised to read as follows:

§ 86.1840–01 Special test procedures.

(a) The Administrator may, on the basis of written application by a manufacturer, prescribe test procedures, other than those set forth in this part, for any light-duty vehicle, light-duty truck, or complete heavy-duty vehicle which the Administrator determines is not susceptible to satisfactory testing by the procedures set forth in this part.

(b) If the manufacturer does not submit a written application for use of special test procedures but the Administrator determines that a light-duty vehicle, light-duty truck, or complete heavy-duty vehicle is not susceptible to satisfactory testing by the procedures set forth in this part, the Administrator shall notify the manufacturer in writing and set forth the reasons for such rejection in accordance with the provisions of § 86.1848(a)(2).

66. Section 86.1844–01 is amended by revising the fourth sentence of paragraph (d)(12), the fourth sentence of paragraph (e)(3), and paragraph (g)(5), and adding paragraph (g)(14) to read as follows:

§ 86.1844–01 Information requirements: Application for certification and submittal of information upon request.

* * * * *

(d) * * *

(12) * * * The description shall include, but is not limited to, information such as model name, vehicle classification (light-duty vehicle, light-duty truck, or complete heavy-duty vehicle), sales area, engine displacement, engine code, transmission type, tire size and parameters necessary to conduct exhaust emission tests such as equivalent test weight, curb and gross vehicle weight, test horsepower (with and without air conditioning adjustment), coast down time, shift schedules, cooling fan configuration, etc. and evaporative tests such as canister working capacity, canister bed volume and fuel temperature profile. * * *

* * * * *

(e) * * *

(3) * * * The description shall include, but is not limited to, information such as model name, vehicle classification (light-duty vehicle, light-duty truck, or complete heavy-duty vehicle), sales area, engine displacement, engine code, transmission type, tire size and parameters necessary to conduct exhaust emission tests such as equivalent test weight, curb and gross vehicle weight, test horsepower (with and without air conditioning adjustment), coast down time, shift schedules, cooling fan configuration, etc and evaporative tests such as canister working capacity, canister bed volume and fuel temperature profile. * * *

* * * * *

(g) * * *

(5) Any information necessary to demonstrate that no defeat devices are present on any vehicles covered by a certificate including, but not limited to, a description of the technology employed to control CO emissions at intermediate temperatures, as applicable.

* * * * *

(14) For complete heavy-duty vehicles only, all hardware (including scan tools) and 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. 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 milers per hour or per kilometer.

* * * * *

67. Section 86.1845–01 is amended by revising paragraph (a), to read as follows:

§ 86.1845–01 Manufacturer in-use verification testing requirements.

(a) *General requirements.* A manufacturer light-duty vehicles, light-duty trucks, and complete heavy-duty vehicles shall test, or cause to have tested a specified number of light-duty vehicles, light-duty trucks, and complete heavy-duty vehicles. Such testing shall be conducted in accordance with the provisions of this section. For purposes of this section, the term vehicle shall include light-duty vehicles, light-duty trucks, and complete heavy-duty vehicles.

* * * * *

68. Section 86.1845–04 is amended by revising paragraph (a), to read as follows:

§ 86.1845–04 Manufacturer in-use verification testing requirements.

(a) *General requirements.* A manufacturer light-duty vehicles, light-duty trucks, and complete heavy-duty vehicles shall test, or cause to have tested a specified number of light-duty vehicles, light-duty trucks, and complete heavy-duty vehicles. Such testing shall be conducted in accordance with the provisions of this section. For purposes of this section, the term vehicle shall include light-duty vehicles, light-duty trucks, and complete heavy-duty vehicles.

* * * * *

69. A new section 86.1846–07 is added to subpart S, to read as follows:

§ 86.1846–07 Manufacturer in-use confirmatory testing.

(a) *General requirements.* A manufacturer of light-duty vehicles, light-duty trucks, and/or complete heavy-duty vehicles shall test, or cause testing to be conducted, under this section when the emission levels shown by a test group sample from testing under § 86.1845–04 exceeds the criteria specified in paragraph (b) of this section. The testing required under this section applies separately to each test group and at each test point (low and high mileage) that meets the specified criteria. The testing requirements apply separately for each model year, starting with model year 2006.

(b) *Criteria for additional testing.* A manufacturer shall test a test group or a subset of a test group as described in paragraph (j) of this section when the results from testing conducted under § 86.1845–04 show mean emissions for that test group of any pollutant(s) to be equal to or greater than 1.30 times the applicable in-use standard and a failure rate, among the test group vehicles, for the corresponding pollutant(s) of fifty percent or greater.

(1) This requirement does not apply to Supplemental FTP testing conducted under § 86.1845–04(b)(5)(i) or evaporative/refueling testing conducted under § 86.1845–04. Testing conducted at high altitude under the requirements of § 86.1845–04 will be included in determining if a test group meets the criteria triggering testing required under this section.

(2) The vehicle tested under the requirements of § 86.1845–04(c)(2)(i) with a minimum odometer miles of 75% of useful life will not be included in determining if a test group meets the triggering criteria.

(3) The SFTP composite emission levels shall include the IUVP FTP emissions, the IUVP US06 emissions, and the values from the SC03 Air Conditioning EDV certification test (without DFs applied). The calculations shall be made using the equations prescribed in § 86.164–01. If more than one set of certification SC03 data exists (due to running change testing or other reasons), the manufacturer shall choose the SC03 result to use in the calculation from among those data sets using good engineering judgment.

(c) *Useful life.* Vehicles tested under the provisions of this section must be within the useful life specified for the emission standards which were exceeded in the testing under § 86.1845–04. Testing should be within the useful life specified, subject to sections 207(c)(5) and (c)(6) of the Clean Air Act where applicable.

(d) *Number of test vehicles.* A manufacturer must test a minimum of ten vehicles of the test group or Agency-designated subset. A manufacturer may, at the manufacturer's discretion, test more than ten vehicles under this paragraph for a specific test group or Agency-designated subset. If a manufacturer chooses to test more than the required ten vehicles, all testing must be completed within the time designated in the testing completion requirements of paragraph (g) of this section. Any vehicles which are eliminated from the sample either prior to or subsequent to testing, or any vehicles for which test results are determined to be void, must be replaced in order that the final sample of vehicles for which test results acceptable to the Agency are available equals a minimum of ten vehicles. A manufacturer may cease testing with a sample of five vehicles if the results of the first five vehicles tested show mean emissions for each pollutant to be less than 75.0 percent of the applicable standard, with no vehicles exceeding the applicable standard for any pollutant.

(e) *Emission Testing.* Each test vehicle of a test group or Agency-designated subset shall be tested in accordance with the Federal Test Procedure and/or the Supplemental Federal Test Procedure (whichever of these tests performed under § 86.1845–04 produces emission levels requiring testing under this section) as described in subpart B of this part, when such test vehicle is tested for compliance with applicable exhaust emission standards under this subpart.

(f) *Geographical limitations.* (1) Test groups or Agency-designated subsets certified to 50-state standards: For low altitude testing no more than 50 percent of the test vehicles may be procured from California. The test vehicles procured from the 49 state area must be procured from a location with a heating degree day 30 year annual average equal to or greater than 4000.

(2) Test groups or Agency-designated subsets certified to 49 state standards: For low-altitude testing all vehicles shall be procured from a location with a heating degree day 30 year annual average equal to or greater than 4000.

(3) Vehicles procured for high altitude testing may be procured from any area provided that the vehicle's primary area of operation was above 4000 feet.

(g) *Testing.* Testing required under this section must commence within three months of completion of the testing under § 86.1845–04 which triggered the confirmatory testing and must be completed within seven months of the completion of the testing which triggered the confirmatory testing. Any industry review of the results obtained under § 86.1845–04 and any additional vehicle procurement and/or testing which takes place under the provisions of § 86.1845–04 which the industry believes may affect the triggering of required confirmatory testing must take place within the three month period. The data and the manufacturers reasoning for reconsideration of the data must be provided to the Agency within the three month period.

(h) *Limit on manufacturer conducted testing.* For each manufacturer, the maximum number of test group(s)(or Agency-designated subset(s))of each model year for which testing under this section shall be required is limited to 50 percent of the total number of test groups of each model year required to be tested by each manufacturer as prescribed in § 86.1845–04 rounded to the next highest whole number where appropriate. For each manufacturer with only one test group under § 86.1845–04, such manufacturer shall have a maximum potential testing requirement under this section of one test group (or Agency-designated subset) per model year.

(i) Prior to beginning in-use confirmatory testing the manufacturer must, after consultation with the Agency, submit a written plan describing the details of the vehicle procurement, maintenance, and testing procedures (not otherwise specified by regulation) it intends to use.

(j) *Testing a subset.* EPA may designate a subset of the test group based on transmission type for testing under this section in lieu of testing the entire test group when the results for the entire test group from testing conducted under § 86.1845–04 show mean emissions and a failure rate which meet these criteria for additional testing.

70. Section 86.1848–01 is amended by revising paragraphs (c)(4) and the first sentence of paragraph (e) introductory text to read as follows:

§ 86.1848–01 Certification.

* * * * *

(c) * * *

(4) For incomplete light-duty trucks and incomplete heavy-duty vehicles, a certificate covers only those new motor vehicles which, when completed by having the primary load-carrying device or container attached, conform to the maximum curb weight and frontal area limitations described in the application for certification as required in § 86.1844–01.

* * * * *

(e) A manufacturer of new light-duty vehicles, light-duty trucks, and complete heavy-duty vehicles must obtain a certificate of conformity covering such vehicles from the Administrator prior to selling, offering for sale, introducing into commerce, delivering for introduction into commerce, or importing into the United States the new vehicle. * * *

* * * * *

[FR Doc. 99–26795 Filed 10–28–99; 8:45 am]
BILLING CODE 6560–50–P