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Part II

Environmental Protection Agency

40 CFR Part 86, 89, et al.

Control of Air Pollution From New Motor Vehicles and New Motor Vehicle Engines; Final Rule

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 86, 89, 90, 1027, 1033, 1042, 1048, 1054, 1060, 1065, and 1068

[EPA–HQ–OAR–2005–0047; FRL–8750–3]

RIN 2060–AL92

Control of Air Pollution From New Motor Vehicles and New Motor Vehicle Engines; Regulations Requiring Onboard Diagnostic Systems on 2010 and Later Heavy-Duty Engines Used in Highway Applications Over 14,000 Pounds; Revisions to Onboard Diagnostic Requirements for Diesel Highway Heavy-Duty Vehicles Under 14,000 Pounds

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule.

SUMMARY: In 2001, EPA finalized a new, major program for highway heavy-duty engines. That program, the Clean Diesel Trucks and Buses program, will result in the introduction of advanced emissions control systems such as catalyzed diesel particulate filters (DPF) and catalysts capable of reducing harmful nitrogen oxide (NO_X) emissions. This final rule will require that these advanced emissions control systems be monitored for malfunctions via an onboard diagnostic system (OBD), similar to those systems that have been required on passenger cars since the mid-1990s. This final rule will require manufacturers to install OBD systems that monitor the functioning of emission control components and alert the vehicle operator to any detected need for emission related repair. This final rule will also require that manufacturers make available to the service and repair industry information necessary to perform repair and maintenance service on OBD systems and other emission related engine components. Lastly, this final rule revises certain existing OBD requirements for diesel engines used in heavy-duty vehicles under 14,000 pounds.

DATES: This rule is effective on April 27, 2009. The incorporation by reference of certain publications listed in this regulation is approved by the Director of the Federal Register as of April 27, 2009.

ADDRESSES: EPA has established a docket for this action under Docket ID No. EPA–HQ–OAR–2005–0047. All documents in the docket are listed in the *http://www.regulations.gov* index. Although listed in the index, some information is not publicly available, e.g., Confidential Business Information (CBI) or other information whose disclosure is restricted by statute. Certain other material, such as copyrighted material, will be publicly available only in hard copy. Publicly available docket materials are available either electronically in *http://www.regulations.gov* or in hard copy at the Air Docket, EPA/DC, EPA West, Room B102, 1301 Constitution Ave., NW., Washington, DC. The Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number for the Air Docket is (202) 566–1742.

FOR FURTHER INFORMATION CONTACT: Todd Sherwood, U.S. EPA, National Vehicle and Fuel Emissions Laboratory, Assessment and Standards Division, 2000 Traverwood Drive, Ann Arbor, MI 48105; telephone (734) 214–4405, fax (734) 214–4816, e-mail *sherwood.todd@epa.gov*.

SUPPLEMENTARY INFORMATION:

Regulated Entities

This action will affect you if you produce or import new heavy-duty engines which are intended for use in highway vehicles such as trucks and buses, or produce or import such highway vehicles, or convert heavy-duty vehicles or heavy-duty engines used in highway vehicles to use alternative fuels.

The following table gives some examples of entities that may have to follow the regulations. But because these are only examples, you should carefully examine the regulations in 40 CFR part 86. If you have questions, call the person listed in the **FOR FURTHER INFORMATION CONTACT** section of this preamble:

Category	NAICS codes [a]	SIC codes [b]	Examples of potentially regulated entities
Industry	336111	3711	Motor Vehicle Manufacturers; Engine and Truck Manufacturers.
	336112		
	336120		
Industry	811112	7533	Commercial Importers of Vehicles and Vehicle Components.
	811198	7549	
	541514	8742	
Industry	336111	3592	Alternative fuel vehicle converters.
	336312	3714	
	422720	5172	
	454312	5984	
	811198	7549	
	541514	8742	
	541690	8931	

[a] North American Industry Classification Systems (NAICS).
[b] Standard Industrial Classification (SIC) system code.

Outline of This Preamble

I. Overview

A. Background

Section 202(m) of the CAA, 42 U.S.C. 7521(m), directs EPA to promulgate regulations requiring 1994 and later model year light-duty vehicles (LDVs) and light-duty trucks (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, ''The Administrator may, in the Administrator's discretion, promulgate regulations requiring manufacturers to install such onboard diagnostic systems on heavy-duty vehicles and engines.''

On February 19, 1993, we published a final rule requiring manufacturers of light-duty applications to install such OBD systems on their vehicles beginning with the 1994 model year (58 FR 9468). The OBD systems must monitor emission control components for any malfunction or deterioration that could cause emissions to exceed certain emission thresholds. The regulation also required that the driver be notified of any need for repair via a dashboard light, or malfunction indicator light (MIL), when the diagnostic system detected a problem. We also allowed 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, most of which served to align the EPA OBD requirements with revisions to the California OBDII requirements (13 CCR 1968.2).

On August 9, 1995, EPA published a final rulemaking that set forth service information regulations for light-duty vehicles and light-duty trucks (60 FR 40474). These regulations, in part, required each Original Equipment Manufacturer (OEM) to do the following: (1) List all of its emission-related service and repair information on a Web site called FedWorld (including the cost of each item and where it could be purchased); (2) either provide enhanced information to equipment and tool companies or make its OEM-specific diagnostic tool available for purchase by aftermarket technicians, and (3) make reprogramming capability available to independent service and repair professionals if its franchised dealerships had such capability. These requirements are intended to ensure that aftermarket service and repair facilities have access to the same emission-related service information, in the same or similar manner, as that provided by OEMs to their franchised dealerships. These service information availability requirements have been revised since that first final rule in response to changing technology among other reasons. (68 FR 38428)

In October of 2000, we published a final rule requiring OBD systems on heavy-duty vehicles and engines up to 14,000 pounds GVWR (65 FR 59896). In that rule, we expressed our intention of developing OBD requirements in a future rule for vehicles and engines used in vehicles over 14,000 pounds. We expressed this same intention in our 2007HD highway final rule (66 FR 5002) which established new heavy-duty highway emissions standards for 2007 and later model year engines. In June of 2003, we published a final rule extending service information availability requirements to heavy-duty vehicles and engines weighing up to 14,000 pounds GVWR. We declined extending these requirements to engines above 14,000 pounds GVWR at least until such engines are subject to OBD requirements.

On January 18, 2001, EPA established a comprehensive national control program—the Clean Diesel Truck and Bus program—that regulates the heavy-duty vehicle and its fuel as a single system. (66 FR 5002) As part of this program, new emission standards will begin to take effect in model year 2007 and will apply to heavy-duty highway engines and vehicles. These standards are based on the use of high-efficiency catalytic exhaust emission control devices or comparably effective advanced technologies. Because these devices are damaged by sulfur, the regulation also requires the level of sulfur in highway diesel fuel be reduced by 97 percent.[1]

On January 24, 2007, we proposed new OBD requirements for highway engines used in vehicles greater than 14,000 pounds (72 FR 3200). Today's action finalizes those proposed requirements. Today's action also requires new availability requirements for emission-related service information, also proposed in the January 24, 2007 action, that will make this information more widely available to the industry servicing vehicles over 14,000 pounds.

B. What Is EPA Requiring?

1. OBD Requirements for Engines Used in Highway Vehicles Over 14,000 Pounds GVWR

We believe that OBD requirements should be extended to include over 14,000 pound 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 fuel timing, piston design, combustion chamber design, charge air cooling, use of four valves per cylinder rather than two valves, and piston ring pack design and location improvements. In contrast, the 2004 and 2007 emission standards represent a different sort of technological challenge that are being met with the addition of exhaust gas recirculation (EGR) systems and the addition of exhaust aftertreatment devices such as diesel particulate filters (DPF), sometimes called PM traps, and NO_X catalysts. 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 devices can go unnoticed by the driver, and because their primary purpose is emissions control, and because the level of emission control is on the order of 50 to 99 percent, some form of diagnosis and malfunction detection is crucial. We believe that such detection can be effectively achieved by employing a well designed OBD system.

The same is true for gasoline heavy-duty vehicles and engines. While emission control is managed with both engine design elements and aftertreatment devices, the catalytic converter is the primary emission control feature accounting for over 95 percent of the emission control. We believe that monitoring the emission control system for proper operation is critical to ensure that new vehicles and engines certified to the very low emission standards set in recent years 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.[2] 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 OBD requirements will build on the efforts already undertaken by the industry to ensure that key emissions 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.

Lastly, heavy-duty engines and, in particular, diesel engines tend to have very long useful lives. With age comes deterioration and a tendency toward increasing emissions. With the OBD systems we are requiring, we expect that these engines will continue to be properly maintained and therefore will continue to emit at low emissions levels even after accumulating hundreds of thousands and even a million miles.

For the reasons laid out above, most manufacturers of vehicles, trucks, and engines have incorporated some type of OBD system into their products that are capable of identifying when certain types of malfunctions occur, and in what systems. In the heavy-duty industry, those OBD systems traditionally have been geared toward detecting malfunctions causing drivability 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 drivability 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

[1] Note that the 2007HD highway rule contained new emissions standards for gasoline engines as well as diesel engines.

[2] See ''On-Board Diagnostics, A Heavy Duty Perspective,'' SAE 951947; ''Recommended Practice for a Serial Control and Communications Vehicle Network,'' SAE J1939 which may be obtained from Society of Automotive Engineers International, 400 Commonwealth Dr., Warrendale, PA, 15096–0001; and ''Road Vehicles-Diagnostics on Controller Area Network (CAN)—Part 4: Requirements for emission-related systems,'' ISO 15765–4:2001 which may be obtained from the International Organization for Standardization, Case Postale 56, CH–1211 Geneva 20, Switzerland.

be avoided by incorporating an OBD system capable of detecting emission control system malfunctions.

2. Requirements That Service Information Be Made Available

We are requiring that makers of engines that go into vehicles over 14,000 pounds make available to any person engaged in repair or service all information necessary to make use of the OBD systems and for making emission-related repairs, including any emissions-related information that is provided by the OEM to franchised dealers. This information includes, but is not limited to, manuals, technical service bulletins (TSBs), a general description of the operation of each OBD monitor, etc. We discuss the new requirements further in section III of this preamble.

The new requirements are similar to those required currently for all 1996 and newer light-duty vehicles and light-duty trucks and 2005 and newer heavy-duty applications up to 14,000 pounds. See section III for a complete discussion of the new service information provisions. Note that information for making emission-related repairs does not include information used to design and manufacture parts, but it may include OEM changes to internal calibrations and other indirect information, as discussed in section III.

3. OBD Requirements for Diesel Heavy-Duty Vehicles and Engines Used in Vehicles Under 14,000 Pounds

We are also making some changes to the existing diesel OBD requirements for heavy-duty applications under 14,000 pounds (i.e., 8,500 to 14,000 pounds). Some of these changes are being made for immediate implementation to relax some of the requirements that we currently have in place for 8,500 to 14,000 pound applications that cannot be met by diesels without granting widespread deficiencies to industry. Other changes are being made for the 2010 and later model years since they represent an increase in the stringency of our current OBD requirements and, therefore, some leadtime is necessary for manufacturers to comply. All of the changes being made for 8,500 to 14,000 pound diesel applications will result in OBD emissions thresholds identical, for all practical purposes, to the OBD thresholds for over 14,000 pound applications.

4. Technical Amendments for Other Programs

We are finalizing a variety of technical amendments in this final rule. Most of these changes involve minor adjustments or corrections to the regulations we adopted on October 8, 2008 (73 FR 59034) and on June 30, 2008 (73 FR 37096). See the memorandum in the docket entitled ''Technical Amendments to EPA Regulations'' for a description of these changes.[3]

C. Why Is EPA Promulgating These Requirements?

1. Highway Engines and Vehicles Contribute to Serious Air Pollution Problems

The pollution emitted by heavy-duty highway engines contributes greatly to our nation's continuing air quality problems. Our 2007HD highway rule was designed to address these serious air quality problems. These problems include premature mortality, aggravation of respiratory and cardiovascular disease, aggravation of existing asthma, acute respiratory symptoms, chronic bronchitis, and decreased lung function. Numerous studies also link diesel exhaust to increased incidence of lung cancer. We believe that exposure to diesel exhaust is likely to be carcinogenic to humans by inhalation and that this cancer hazard exists for occupational and environmental levels of exposure.

Our 2007HD highway rule regulates the heavy-duty vehicle and its fuel as a single system. As part of this program, new emission standards began to take effect in model year 2007 and are phased-in through model year 2010, and will apply to heavy-duty highway engines and vehicles. These standards are based on the use of high-efficiency catalytic exhaust emission control devices or comparably effective advanced technologies and a cap on the allowable sulfur content in both diesel fuel and gasoline.

In the 2007HD highway final rule, we estimated that, by 2007, heavy-duty trucks and buses would account for about 28 percent of nitrogen oxides emissions and 20 percent of particulate matter emissions from mobile sources. In some urban areas, the contribution is even greater. The 2007HD highway program will reduce particulate matter and oxides of nitrogen emissions from heavy-duty engines by 90 percent and 95 percent below current standard levels, respectively. In order to meet these more stringent standards for diesel engines, the program calls for a 97 percent reduction in the sulfur content of diesel fuel. As a result, diesel vehicles will achieve gasoline-like exhaust emission levels. We have also established more stringent standards for heavy-duty gasoline vehicles, based in part on the use of the low sulfur gasoline that will be available when the standards go into effect.

2. Emissions Control of Highway Engines and Vehicles Depends on Properly Operating Emissions Control Systems

The emissions reductions and resulting health and welfare benefits of the 2007HD highway program will be dramatic when fully implemented. By 2030, the program will reduce annual emissions of nitrogen oxides, nonmethane hydrocarbons, and particulate matter by a projected 2.6 million, 115,000 and 109,000 tons, respectively. However, to realize those large emission reductions and health benefits, the emission control systems on heavy-duty highway engines and vehicles must continue to provide the 90 to 95 percent emission control effectiveness throughout their operating life. Today's OBD requirements, in conjunction with/support of EPA's existing compliance programs, will help to ensure that emission control systems continue to operate properly by detecting when those systems malfunction, by then notifying the driver that a problem exists that requires service and, lastly, by informing the service technician what the problem is so that it can be properly repaired.

3. Basis for Action Under the Clean Air Act

Section 202(m) of the CAA, 42 U.S.C. 7521(m), directs EPA to promulgate regulations requiring 1994 and later model year light-duty vehicles (LDVs) and light-duty trucks (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, ''The Administrator may, in the Administrator's discretion, promulgate regulations requiring manufacturers to install such onboard diagnostic systems on heavy-duty vehicles and engines.''

Section 202(m)(5) of the CAA states that the Administrator shall require manufacturers to, ''provide promptly to any person engaged in the repairing or servicing of motor vehicles or motor vehicle engines * * * with any and all information needed to make use of the emission control diagnostics system prescribed under this subsection and such other information including

[3] See Document ID No. EPA–HQ–OAR–2005–0047–0057. Also see Document ID No. EPA–HQ–OAR–2005–0047–0058.

instructions for making emission related diagnosis and repairs.''

4. The Importance of a Nationwide HDOBD Program

In 2005, the California Air Resources Board put into place HDOBD requirements.[4] More recently, we granted a waiver from federal preemption to the State of California that allows them to implement the HDOBD program (73 FR 52042). Given the nature of the heavy-duty trucking industry in the United States and the importance of the free and open movement of goods across state borders, we believe that a consistent nationwide HDOBD program is a desirable outcome. We have worked closely with California on our proposal and with both California and industry stakeholders on this final rule, in an effort to develop a consistent set of HDOBD requirements. As a result, the program we are finalizing today is consistent with the California program in almost all important aspects. We believe that, while minor differences exist in the requirements we are promulgating today and the California requirements, we will end up with OBD systems that will be compliant with both our federal program and the California program. Promulgating and implementing this final rule is an important step in our efforts working with the California Air Resources Board to develop a consistent national program.

5. Worldwide Harmonized OBD (WWH–OBD)

The Worldwide Harmonized OBD effort (WWH–OBD) is part of the United Nations Economic Commission for Europe. We discussed this effort in detail in our proposal. In line with what we said in our proposal, while the WWH–OBD global technical regulation (gtr) is consistent with many of the specific requirements of our final rule, it is not currently as comprehensive (e.g., it does not contain the same level of detail with respect to certification requirements and enforcement provisions). For that reason, at this time, we do not believe that the gtr could fully replace what is in our final rule. It is important to note that California had HDOBD requirements in place prior to the WWH–OBD gtr being adopted as a final document. The California HDOBD requirements were analogous to the WWH–OBD requirements, but were not identical. At industry's request, we have patterned both our proposal and final rule after the California regulation. Note that we have an obligation to one day propose the gtr for consideration as a U.S. regulation, and it is our expectation that working together with industry and other stakeholders we will determine the appropriate process and requirements to incorporate the WWH–OBD requirements into our regulatory structure.

[4] See 13 CCR 1971.1.

II. How Have the Proposed OBD Requirements Been Changed for This Final Rule and When Will They Be Implemented?

The following subsections describe how we have changed the proposed OBD monitoring requirements in this final rule. We also describe the timelines for their implementation. The requirements are indicative of our goal for the program which is a set of OBD monitors that provide robust diagnosis of the emission control system. Our intention is to provide industry sufficient time and experience with satisfying the demands of the OBD program. While their engines already incorporate OBD systems, those systems are generally less comprehensive and do not monitor the emission control system in the ways we are requiring. Additionally, the OBD requirements represent a new set of technological requirements and a new set of certification requirements for the industry in addition to the 2007HD highway program and the challenging emission standards for PM and NO_X and other pollutants to be implemented in 2010. As a result, we believe the monitoring requirements and timelines outlined in this section appropriately weigh the need for OBD monitors on the emission control system and the need to gain experience with not only those monitors but also the newly or recently added emission control hardware.

The changes we have made to the proposed requirements are the result of comments received on our proposal and meetings with stakeholders held in the time between proposal and final rule. The changes are also the result of our collaboration with CARB staff. For a detailed summary and analysis of the comments we received, and the rationale behind the changes made for this final rule, refer to the Summary and Analysis document contained in the docket for this rule.

In general, the remainder of this preamble—in particular, sections II.B through II.H—presents the changes made to the final OBD requirements relative to the proposed OBD requirements. As such, we do not restate details of the proposed requirements unless it is necessary to do so for clarity. Of interest to readers when comparing the final OBD regulatory text to the proposed OBD regulatory text is that we have moved all of the requirements for over 14,000 pound OBD into § 86.010–18. Where certain requirements are not applicable until 2013 or 2016, etc., the regulatory text in § 86.010–18 makes that clear. In our proposal, we had separated out the requirements for model year 2013 into § 86.013–18 and those for 2016 into § 86.016–18 and those for 2019 into § 86.019–18. This created some confusion and we decided that it would be easier to read the regulations if we restructured things such that all the requirements appear in one section. We have done so in the final rule and have placed all requirements for over 14,000 pound OBD in § 86.010–18. This is also true for OBD requirements on heavy-duty engines under 14,000 pounds where we have moved proposed provisions for model years 2010 through 2012 and 2013 and later from proposed §§ 86.010–17 and 86.013–17, respectively to final § 86.007–17 with appropriate mention of when requirements apply to specific model years. The same holds true for proposed §§ 86.1806–07, 86.1806–10, and 86.1806–13, for OBD systems on under 14,000 pound vehicles, where all final OBD requirements can be found in § 86.1806–05 with appropriate mention of when requirements apply to specific model years.

The remainder of Section II below highlights the changes made to our proposed requirements relative to the final rule. The reader is directed to the more detailed discussion that follows and/or is found in our Summary and Analysis of Comments document contained in the docket. However, Table II–1 provides a brief summary of the changes made although this tabular summary is not meant to provide a thorough explanation of each change. For a thorough explanation, refer to the more detailed discussion below and/or the Summary and Analysis of Comments.

TABLE II–1—SUMMARY OF CHANGES IN THE FINAL REGULATIONS RELATIVE TO THE PROPOSED REGULATIONS

[Please refer to the text for acronym definitions]

Change	Discussed in preamble section	Regulatory cite
Restructuring—§§ 86.013–18, 86.016–18, 86.019–18 have been moved into § 86.010–18 with appropriate date qualifiers.	II Introduction	All >14,000 pound OBD text now in § 86.010–18.
Allow EPA to certify systems demonstrated to comply with CARB HDOBD (13 CCR 1971.1)	II.A.5	§ 86.010–18(a)(5).
Changed MIL location requirement to read "primary driver's side" rather than "driver's side" to accommodate vehicles with both left and right side steering.	*	§ 86.010–18(b)(1)(i).
Slight change to erasure of pending DTC upon storage of MIL-on DTC	II.A.2	§ 86.010–18(b)(2)(ii).
Change to the permanent DTC erasure provisions	II.F.4	§ 86.010–18(b)(3)(iii)(A)–(D).
Minor revisions, for clarity, to the general provisions governing monitoring conditions	*	§ 86.010–18(c)(3).
Added clarifying text to general provisions governing in-use performance tracking	*	§ 86.010–18(d).
Revision to trip definition, in the context of rate based monitoring, for denominator incrementing on diesel engines.	II.E.1	§ 86.010–18(d)(4)(ii)(B).
Change to idle definition in specifications for incrementing the denominator (from vehicle speed ≤1 mph to "engine speed less than or equal to 200 rpm above normal warmed up idle or vehicle speed ≤1 mph").	II.E.2	§ 86.010–18(d)(4)(ii)(C).
Added text stating that monitors must run over test that gives the most robust monitor rather than most stringent monitor.	II.A.4	§ 86.010–18(f)(1)(i).
Added text to identify in certification documentation which test cycle would provide the most stringent and/or the most robust monitor.	*	§ 86.010–18(f)(1)(ii).
Added text stating that OBD-specific IRAFs need not be included in OBD threshold determinations.	II.A.4	§ 86.010–18(f)(2).
Revision to NO_X malfunction thresholds for NO_X catalyst systems and NO_X sensors (2010–2012 only).	II.B.6; II.B.7; II.B.9 (and shown in Table II.B–1.	§ 86.010–18(g), Table 1.
Added provision to diesel fuel system pressure, timing, and quantity malfunction criteria allowing unit injector systems to conduct functional checks during model years 2010 to 2012.	II.B.1	§ 86.010–18(g)(1)(ii)(A)–(C).
Added new paragraph allowing diesel unit injector systems to combine into one malfunction the three separate malfunction criteria of pressure, timing, and quantity.	II.B.1	§ 86.010–18(g)(1)(ii)(D).
Minor changes to diesel fuel system monitoring conditions consistent with changes to malfunction criteria.	II.B.1	§ 86.010–18(g)(1)(iii)(A) & (B).
Diesel engine misfire malfunction criteria for multiple continuous misfire changed from "more than one cylinder" to "more than one or more than one but less than half (if approved)".	II.B.2	§ 86.010–18(g)(2)(ii)(A).
Minor change to diesel EGR monitoring conditions (i.e., a change to the proposed monitoring conditions) which allows for temporary disables of "continuous monitoring".	II.B.3	§ 86.010–18(g)(3)(iii)(D).
Diesel turbo boost malfunction criteria changed to note "for engines so equipped" where appropriate.	II.B.4	§ 86.010–18(g)(4)(ii)(A)–(C).
Added a new diesel turbo boost monitoring condition that allows for temporary disables of "continuous monitoring".	II.B.4	§ 86.010–18(g)(4)(iii)(D).
Removed text noting that NMHC conversion over a DPF is required under paragraph (g)(8) and added clarifying text that monitoring of NMHC conversion over a DPF is not required.	II.B.8	§ 86.010–18(g)(5)(i).
Removal of malfunction thresholds from diesel NMHC catalyst malfunction criteria	II.B.5	§ 86.010–18(g)(5)(ii)(A).
Added "delta temperature within time period" provision to diesel NMHC aftertreatment assistance malfunction criteria.	II.B.5	§ 86.010–18(g)(5)(ii)(B).
Removal of proper feedgas generation malfunction criteria for diesel NMHC catalysts	II.B.5	§ 86.010–18(g)(5)(ii)(B).
Added provision to forego monitoring of diesel NMHC catalysts located downstream of a DPF provided their malfunction will not result in failure of the NMHC emission standard.	II.B.5	§ 86.010–18(g)(5)(ii)(B).
Change to the DPF malfunction criteria—addition of an optional malfunction criteria for DPF filtering performance for model years 2010 to 2012.	II.B.8	§ 86.010–18(g)(8)(ii)(A).
Change to the DPF malfunction criteria—removal of NMHC conversion monitoring	II.B.8	§ 86.010–18(g)(8)(ii)(D)**.
Added new monitoring conditions applicable to those systems using the optional DPF malfunction criteria of § 86.010–18(g)(8)(ii)(A).	II.B.8	§ 86.010–18(g)(8)(iii).
Added provision that allows Administrator to approve limited misfire monitor disablement for gasoline engines.	II.C	§ 86.010–18(h)(2)(iii)(D).
Added provision that allows misfire monitor disables for gasoline engines with >8 cylinders	II.C	§ 86.010–18(h)(2)(iii)(E).
Added phrase allowing lower thermostat regulating temperature requirement for ambient temperatures between 20–50 degrees F.	II.D.2	§ 86.010–18(i)(1)(ii)(A).
Added phrase "With Administrator approval" to the provision allowing alternative thermostat malfunction criteria.	*	§ 86.010–18(i)(1)(ii)(B).
Change to the comprehensive component monitoring requirements such that components must be monitored if their malfunction can cause emissions to exceed standards rather than affect emissions during any reasonable driving condition.	II.D.4	§ 86.010–18(i)(3)(i)(A).
Change to diesel engine glow plug malfunction criteria for 2010–2012	II.D.4	§ 86.010–18(i)(3)(iii)(D).
Added provision stating that monitoring of wait-to-start lamp and MIL circuit is not required for systems using light-emitting diodes versus incandescent bulbs.	II.A.2	§ 86.010–18(i)(3)(iii)(E).

TABLE II–1—SUMMARY OF CHANGES IN THE FINAL REGULATIONS RELATIVE TO THE PROPOSED REGULATIONS—Continued

[Please refer to the text for acronym definitions]

Change	Discussed in preamble section	Regulatory cite
Removed introductory text to the standardization requirements (done to provide greater clarity).	*	§ 86.010–18(k)(1).
Removal of SAE J2534 from the OBD section (it remains in the Service Information Availability requirements of § 86.010–38(j)).	*	§ 86.010–18(k)(1)(i)(H)**.
Added text allowing the Administrator to approve alternative DLC locations	II.F.2	§ 86.010–18(k)(2)(i).
Added text allowing data link signals to report an error state or other predefined status indicator if they are defined for those signals in the SAE J1979/J1939 specifications.	*	§ 86.010–18(k)(4)(ii).
Added the phrase "to the extent possible" to the provision to use separate DTCs for out-of-range and circuit checks.	*	§ 86.010–18(k)(4)(iv)(B).
Added provision to allow for multiple CAL IDs with Administrator approval provided CAL IDs response is in order of highest to lowest priority.	II.F.4	§ 86.010–18(k)(4)(vi).
Added provision to require multiple CVNs if using multiple CAL IDs as allowed under newly added provision in (k)(4)(vi).	II.F.4	§ 86.010–18(k)(4)(vii)(A).
Added provision allowing, for 2010–2012, a default value for the CVN for systems that are not field programmable.	*	§ 86.010–18(k)(4)(vii)(A).
Revised CVN calculation requirement from "once per drive cycle" to "once per ignition cycle"	*	§ 86.010–18(k)(4)(vii)(C).
Change to idle definition in engine run-time tracking (from vehicle speed ≤1 mph to "engine speed less than or equal to 200 rpm above normal warmed-up idle or vehicle speed ≤1 mph").	II.F.4; II.F.5	§ 86.010–18(k)(6)(i)(B).
Added new certification demonstration provisions for systems using the optional DPF monitoring provisions.	*	§ 86.010–18(l)(3)(i)(H).
Added new documentation provisions for systems meeting § 86.010–18 with a system designed to CARB 13 CCR 1971.1.	II.A.5	§ 86.010–18(m)(3).
Added a provision that allows Administrator to approve alternative engine ratings as parent ratings in 2010–2012.	II.G.1	§ 86.010–18(o)(1)(i).
Added a provision that allows Administrator to approve alternative engine ratings as parent ratings in 2010–2012.	II.G.1	§ 86.010–18(o)(2)(ii)(B).
Added text to make clear that for all engine ratings in years 2019+, the certification emissions thresholds apply in-use (provides clarification, no change to original intent).	*	§ 86.010–18(p)(4)(i).
Revised 2007–2009 and 2010–2012 engine certification NO_X thresholds from FEL+0.5 to FEL+0.6 (for 8500–14K pound diesel engines).	Table II.H–2	§ 86.007–17(b) & § 86.007–30(f).
Added definition of "engine and engine system" applicable to OBD	*	§ 86.010–2.
Moved definition of "OBD group" from § 86.013–2 to § 86.010–2	*	§ 86.010–2.
Added "delta temperature within time period" provision to NMHC malfunction description for engine certifications.	II.H.3	§ 86.007–17(b) & § 86.007–30(f).
Removed 2010–2012 & 2013+ engine certification NMHC thresholds for DPFs (8500–14K pound diesel engines).	Table II.H–2	§ 86.007–17(b) & § 86.007–30(f).
Change to the DPF malfunction criteria—addition of an optional malfunction criteria for DPF filtering performance.	II.H.2	§ 86.007–17(b) & § 86.007–30(f).
§ 86.013–17 moved to § 86.007–17 with appropriate date qualifiers (8500–14K pound diesel engines; no content change, just formatting).	II.A	§ 86.007–17(b).
§ 86.013–30 moved to § 86.007–30 with appropriate date qualifiers (8500–14K pound diesel engines; no content change, just formatting).	II.A	§ 86.007–30(f).
Revised 2007–2009 vehicle certification NO_X thresholds from 3x to 4x the standard (8500–14K pound diesel vehicles).	Table II.H–2	§ 86.1806–05(n) & (o).
Revised 2010–2012 vehicle certification NO_X thresholds for NO_X catalysts and NO_X sensors from +0.3 to +0.6 (8500–14K pound diesel vehicles).	Table II.H–2	§ 86.1806–05(n) & (o).
Added "delta temperature within time period" provision to NMHC malfunction description for vehicle certifications.	II.H.3	§ 86.1806–05(n) & (o).
Removed 2010–2012 & 2013+ vehicle certification NMHC thresholds for DPFs (8500–14K pound diesel vehicles).	Table II.H–2	§ 86.1806–05(n) & (o).
Added the phrase "and superseding sections" to the provision for optional chassis certification of diesel vehicles.	*	§ 86.1863–07.

* Items not discussed in the preamble since we consider them to be very minor.

** This is the applicable citation for the proposed regulatory text, but this paragraph contains different text (due to renumbering) or has been removed in the final regulatory text.

A. General OBD System Requirements

1. The OBD System

The OBD system must be designed to operate for the actual life of the engine in which it is installed. Further, the OBD system cannot be programmed or otherwise designed to deactivate based on age and/or mileage of the vehicle during the actual life of the engine. This requirement does not alter existing law and enforcement practice regarding a manufacturer's liability for an engine beyond its regulatory useful life, except where an engine has been programmed or otherwise designed so that an OBD system deactivates based on age and/or mileage of the engine.

In addition, computer coded engine operating parameters cannot be changeable without the use of specialized tools and procedures (e.g. soldered or potted computer components or sealed (or soldered) computer enclosures). Upon Administrator approval, certain product lines may be exempted from this requirement if those product lines can be shown to not need such protections. In making the approval decision, the Administrator will consider such things as the current availability of performance chips, performance capability of the engine, and sales volume.

2. Malfunction Indicator Light (MIL) and Diagnostic Trouble Codes (DTC)

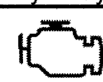
Consistent with our proposal, the final rule requires that upon detecting a malfunction within the emission control system,[5] the OBD system must make some indication to the driver so that the driver can take action to get the problem repaired. A dashboard malfunction indicator light (MIL) must be illuminated to inform the driver that a problem exists that needs attention.

Upon illumination of the MIL, a diagnostic trouble code (DTC) must be stored in the engine's computer that identifies the detected malfunction. This DTC can then be read by a service technician to assist in making the necessary repair.

Because the MIL is meant to inform the driver of a detected malfunction, we are requiring that the MIL be located on the driver's side instrument panel and be of sufficient illumination and location to be readily visible under all lighting conditions. We are requiring that the MIL be amber (yellow) in color when illuminated because yellow is synonymous with the notion of a ''cautionary warning''; the use of red for the MIL will be strictly prohibited because red signifies ''danger'' which is not the proper message for malfunctions detected according to today's rule. Further, we are requiring that, when illuminated, the MIL display the International Standards Organization (ISO) engine symbol shown in Table II.A–1 because this symbol has become accepted after more than 10 years of light-duty OBD as a communicator of engine and emissions system related problems. We are also requiring that there be only one MIL used to indicate all malfunctions detected by the OBD system on a single vehicle. We believe this is important to avoid confusion over multiple lights and, potentially, multiple interpretations of those lights.

Generally, a manufacturer would be allowed sufficient time to be certain that a malfunction truly exists before illuminating the MIL. No one benefits if the MIL illuminates spuriously when a real malfunction does not exist. Thus, for most OBD monitoring strategies, manufacturers will not be required to illuminate the MIL until a malfunction clearly exists which will be considered to be the case when the same problem has occurred on two sequential driving cycles.[6]

Table II.A-1. ISO Warning Light Symbol

ISO 2575:2004 Designation	Displayed Symbol
F01	

To keep this clear in the onboard computer, we are requiring that the OBD system make certain distinctions between the problems it has detected, and that the system maintain a strict logic for diagnostic trouble code (DTC) storage/erasure and for MIL illumination/extinguishment. Whenever the enable criteria for a given monitor are met, we would expect that monitor to run. For continuous monitors, this would be during essentially all engine operation.[7] For non-continuous monitors, it would be during only a subset of engine operation.[8] In general, we are requiring that non-continuous monitors make a diagnostic decision just once per drive cycle that contains operation satisfying the enable criteria for the given monitor.

When a problem is first detected, we are requiring that a ''pending'' DTC be stored. If, during the subsequent drive cycle that contains operation satisfying the enable criteria for the given monitor, a problem in the components/system is not again detected, the OBD system would declare that a malfunction does not exist and would, therefore, erase the pending DTC. However, if, during the subsequent drive cycle that contains operation satisfying the enable criteria for the given monitor, a problem in the component/system is again detected, a malfunction has been confirmed and, hence, a ''confirmed'' or ''MIL-on'' DTC would be stored.[9] Upon storage of a MIL-on DTC, the pending DTC would either remain stored or be erased, depending on what the manufacturer determines to be the most effective approach. Consistent with the proposal, the final rule does not stipulate which communication protocol be used. Upon storage of the MIL-on DTC, the MIL must be illuminated.[10] Also at this time, a ''permanent'' DTC would be stored (see section II.F.4 for more details regarding permanent DTCs).[11]

As we proposed, we are requiring that, after three subsequent drive cycles that contain operation satisfying the enable criteria for the given monitor without any recurrence of the previously detected malfunction, the MIL should be extinguished (unless there are other MIL-on DTCs stored for which the MIL must also be illuminated), the permanent DTC should be erased, but a ''previous-MIL-

[5] What constitutes a ''malfunction'' for over 14,000 pound applications under today's action is covered in section II.B for diesel engines, section II.C for gasoline engines, and section II.D for all engines.

[6] Generally, a ''driving cycle'' or ''drive cycle'' consists of engine startup and engine shutoff or consists of four hours of continuous engine operation.

[7] A ''continuous'' monitor—if used in the context of monitoring conditions for circuit continuity, lack of circuit continuity, circuit faults, and out-of-range values—means sampling at a rate no less than two samples per second. If a computer input component is sampled less frequently for engine control purposes, the signal of the component may instead be evaluated each time sampling occurs.

[8] A ''non-continuous'' monitor being a monitor that runs only when a limited set of operating conditions occurs.

[9] Different industry standards organizations—the Society of Automotive Engineers (SAE) and the International Standards Organization (ISO)—use different terminology to refer to a ''MIL-on'' DTC. For clarity, we use the term ''MIL-on'' DTC throughout this preamble to convey the concept and not any requirement that standard making bodies use the term in their standards.

[10] Throughout this final rule, we refer to MIL illumination to mean a steady, continuous illumination during engine operation unless stated otherwise. This contrasts with the MIL illumination logic used by many engine manufacturers today by which the MIL would illuminate upon detection of a malfunction but would remain illuminated only while the malfunction was actually occurring. Under this latter logic, an intermittent malfunction or one that occurs under only limited operating conditions may result in a MIL that illuminates, extinguishes, illuminates, etc., as operating conditions change.

[11] A permanent DTC must be stored in a manner such that electrical disconnections do not result in their erasure (i.e., they must be stored in non-volatile random access memory (NVRAM)).

on'' DTC should remain stored.[12] We are requiring that the previous-MIL-on DTC remain stored for 40 engine warmup cycles after which time, provided the identified malfunction has not been detected again and the MIL is presently not illuminated for that malfunction, the previous-MIL-on DTC can be erased.[13] However, if an illuminated MIL is not extinguished, or if a MIL-on DTC is not erased, by the OBD system itself but is instead erased via scan tool or battery disconnect (which would erase all non-permanent, volatile memory), the permanent DTC must remain stored. This way, permanent DTCs can only be erased by the OBD system itself and cannot be erased through human interaction with the system.

As proposed, we are allowing the manufacturer, upon Administrator approval, to use alternative statistical MIL illumination and DTC storage protocols to those described above (i.e., alternatives to the ''first trip—pending DTC, second strip—MIL-on DTC logic). The Administrator will consider whether the manufacturer provided data and/or engineering evaluation adequately demonstrates that the alternative protocols can evaluate system performance and detect malfunctions in a manner that is equally effective and timely. Alternative strategies requiring, on average, more than six driving cycles for MIL illumination would probably not be accepted.

As proposed, upon storage of either a pending DTC and/or a MIL-on DTC, we are requiring that the computer store a set of ''freeze frame'' data. These freeze frame data will provide a snap shot of engine operating conditions present at the time the malfunction occurred and was detected. This information serves the repair technician in diagnosing the problem and conducting the proper repair. The freeze frame data should be stored upon storage of a pending DTC. If the pending DTC matures to a MIL-on DTC, the manufacturer can choose to update the freeze frame data or retain the freeze frame stored in conjunction with the pending DTC. Likewise, any freeze frame stored in conjunction with any pending or MIL-on DTC should be erased upon erasure of the DTC. Further information concerning the freeze frame requirement and the data required in the freeze frame is presented in section II.F.4, below.

As proposed, we are also requiring that the OBD system illuminate the MIL and store a MIL-on DTC to inform the vehicle operator whenever the engine enters a mode of operation that can affect the performance of the OBD system. If such a mode of operation is recoverable (i.e., operation automatically returns to normal at the beginning of the following ignition cycle [14]), then in lieu of illuminating the MIL when the mode of operation is entered, the OBD system may wait to illuminate the MIL and store the MIL-on DTC if the mode of operation is again entered before the end of the next ignition cycle. We are requiring this because many operating strategies are designed such that they continue automatically through to the next key-off. Regardless, upon the next key-on, the engine control would start off in ''normal'' operating mode and would return to the ''abnormal'' operating mode only if the condition causing the abnormal mode was again encountered. In such cases, we are allowing that the MIL be illuminated during the second consecutive drive cycle during which such an ''abnormal'' mode is engaged.[15]

Whether or not the ''abnormal'' mode of operation is recoverable, in this context, has nothing to do with whether the detected malfunction goes away or stays. Instead, it depends solely on whether or not the engine, by design, will stay in abnormal operating mode on the next key-on. We are requiring this MIL logic because often the diagnostic (i.e., monitor) that caused the engine to enter abnormal mode cannot run again once the engine is in the abnormal mode. So, if the MIL logic associated with abnormal mode activation was always a two-trip diagnostic, abnormal mode activation would set a pending DTC on the first trip and, since the system would then be stuck in that abnormal operating mode and would never be able to run the diagnostic again, the pending DTC could never mature to a MIL-on DTC nor illuminate the MIL. Hence, the MIL must illuminate upon the first entry into such an abnormal operating mode. If such a mode is recoverable, the engine will start at the next key-on in ''normal'' mode allowing the monitor to run again and, assuming another detection of the condition, the system would set a MIL-on DTC and illuminate the MIL.

As proposed, the OBD system need not store a DTC nor illuminate the MIL upon abnormal mode operation if other telltale conditions would result in immediate action by the driver. Such telltale conditions would be, for example, an overt indication like a red engine shut-down warning light. The OBD system also need not store a DTC nor illuminate the MIL upon abnormal mode operation if the mode is indeed an auxiliary emission control device (AECD) approved by the Administrator.

There may be malfunctions of the MIL itself that would prevent it from illuminating. A repair technician—or possibly an I/M inspector—would still be able to determine the status of the MIL (i.e., commanded ''on'' or ''off'') by reading electronic information available through a scan tool, but there would be no indication to the driver of an emissions-related malfunction should one occur. Unidentified malfunctions may cause excess emissions to be emitted from the vehicle and may even cause subsequent deterioration or failure of other components or systems without the driver's knowledge. In order to prevent this, the manufacturer must ensure that the MIL is functioning properly. For this reason and consistent with our proposal, we are requiring two checks of the functionality of the MIL itself. First, the MIL will be required to illuminate for a minimum of five seconds when the vehicle is in the key-on, engine-off position. This allows an interested party to check the MIL's functionality simply by turning the key to the key-on position. While the MIL would be physically illuminated during this functional check, the data stream value for the MIL command status would be required to indicate ''off'' during this check unless, of course, the MIL was currently being commanded ''on'' for a detected malfunction. This functional check of the MIL is not required during vehicle operation in the key-on, engine-off position subsequent to the initial engine cranking of an ignition cycle (e.g., due to an engine

[12] This general ''three trip'' condition for extinguishing the MIL is true for all but two diesel systems/monitors—the misfire monitor and the SCR system—and three gasoline systems/monitors—the fuel system, the misfire monitor, and the evaporative system—which have further conditions on extinguishing the MIL. This is discussed in more detail in sections II.B and II.C.

[13] For simplicity, the discussion here refers to ''previous-MIL-on'' DTCs only. The ISO 15765 standard and the SAE J1939 standard use different terms to refer to the concept of a previous-MIL-on DTC. Our intent is to present the concept of our proposal in this preamble and not to specify the terminology used by these standard making bodies.

[14] ''Ignition Cycle'' means a drive cycle that begins with engine start and includes an engine speed that exceeds 50 to 150 rotations per minute (rpm) below the normal, warmed-up idle speed (as determined in the drive position for vehicles equipped with an automatic transmission) for at least two seconds plus or minus one second.

[15] Note that we use the term ''abnormal'' to refer to an operating mode that the engine is designed to enter upon determining that ''normal'' operation cannot be maintained. Therefore, the term ''abnormal'' is somewhat of a misnomer since the engine is doing what it has been designed to do. Nonetheless, the abnormal operating mode is clearly not the operating mode the manufacturer has intended for optimal operation. Such operating modes are sometimes referred to as ''default'' operating modes or ''limp-home'' operating modes.

stall or other non-commanded engine shutoff).

The second functional check of the MIL is a circuit continuity check of the electrical circuit that is used to illuminate the MIL to verify that the circuit is not shorted or open (e.g., a burned out bulb). While there would not be an ability to illuminate the MIL when such a malfunction is detected, the electronically readable MIL command status in the onboard computer would be changed from commanded ''off'' to ''on''. This would allow the truck owner or fleet maintenance staff to quickly determine whether an extinguished MIL means ''no malfunctions'' or ''broken MIL.'' It would also serve, should it become of interest in the future, complete automation of the I/M process by eliminating the need for inspectors to input manually the results of their visual inspections. Feedback from passenger car I/M programs indicates that the current visual bulb check performed by inspectors is subject to error and results in numerous vehicles being falsely failed or passed. By requiring monitoring of the circuit itself, the entire pass/fail criteria of an I/M program could be determined by the electronic information available through a scan tool, thus better facilitating quick and effective inspections and minimizing the chance for manually-entered errors. Unlike our proposal, the final rule does not require this circuit continuity check of the MIL circuit for systems that employ light emitting diode (LED) MILs.[16] These systems are very robust and circuit checks are very difficult and, we believe, unnecessary. We do not want to discourage their use or encourage use of bulb-based MILs over LED MILs via our OBD requirements.

As proposed, the MIL may be used to indicate readiness status in a standardized format (see Section II.F) in the key-on, engine-off position. Readiness status is a term used in light-duty OBD that refers to a vehicle's readiness for I/M inspection. For a subset of monitors—those that are non-continuous monitors for which an emissions threshold exists (see sections II.B and II.C for more on emissions thresholds)—a readiness status indicator must be stored in memory to indicate whether or not that particular monitor has run enough times to make a diagnostic decision. Until the monitor has run sufficient times, the readiness status would indicate ''not ready''. Upon running sufficient times, the readiness status would indicate ''ready.'' This serves to protect against drivers disconnecting their battery just prior to the I/M inspection so as to erase any MIL-on DTCs. Such an action would simultaneously set all readiness status indicators to ''not ready'' resulting in a notice to return to the inspection site at a future date. Readiness indicators also help repair technicians because, after completing a repair, they can operate the vehicle until the readiness status indicates ''ready'' and, provided no DTCs are stored, know that the repair has been successful. We are requiring that HDOBD systems follow this same readiness status logic as used for years in light-duty OBD both to assist repair technicians and to facilitate potential future HDOBD I/M programs.

We are also allowing the manufacturer, upon Administrator approval, to use the MIL to indicate which, if any, DTCs are currently stored (e.g., to ''blink'' the stored codes). The Administrator will approve the request if the manufacturer can demonstrate that the method used to indicate the DTCs will not be unintentionally activated during any inspection test or during routine driver operation.

3. Monitoring Conditions

a. Background

Given that the intent of the OBD requirements is to monitor the emission control system for proper operation, it is logical that the OBD monitors be designed such that they monitor the emission control system during typical driving conditions. While many OBD monitors would be designed such that they are continuously making decisions about the operational status of the engine, many—and arguably the most critical—monitors are not so designed. For example, an OBD monitor whose function is to monitor the active fuel injection system of a NO_X adsorber or a DPF cannot be continuously monitoring that function since that function occurs on an infrequent basis. This OBD monitor presumably would be expected to ''run,'' or evaluate the active injection system, during an actual fuel injection event.

For this reason, manufacturers are allowed to determine the most appropriate times to run their non-continuous OBD monitors. This way, they are able to make an OBD evaluation either at the operating condition when an emission control system is active and its operational status can best be evaluated, and/or at the operating condition when the most accurate evaluation can be made (e.g., highly transient conditions or extreme conditions can make evaluation difficult). Importantly, manufacturers are prohibited from using a monitoring strategy that is so restrictive such that it rarely or never runs. To help protect against monitors that rarely run, we are requiring an ''in-use monitor performance ratio'' requirement which is detailed in section II.E.

The set of operating conditions that must be met so that an OBD monitor can run are called the ''enable criteria'' for that given monitor. These enable criteria are often different for different monitors and may well be different for different types of engines. A large diesel engine intended for use in a Class 8 truck would be expected to see long periods of relatively steady-state operation while a smaller engine intended for use in an urban delivery truck would be expected to see a lot of transient operation. Manufacturers will need to balance between a rather loose set of enable criteria for their engines and vehicles given the very broad range of operation HD highway engines see and a tight set of enable criteria given the desire for greater monitor accuracy.

b. General Monitoring Conditions

i. Monitoring Conditions for All Engines

As guidance to manufacturers, we are providing the following criteria to assist manufacturers in developing their OBD enable criteria. These criteria will be used by the Agency during our OBD certification approval process to ensure that monitors run on a frequent basis during real world driving conditions. These criteria will be:

- The monitors should run during conditions that are technically necessary to ensure robust detection of malfunctions (e.g., to avoid false passes and false indications of malfunctions);
- The monitor enable criteria should ensure monitoring will occur during normal vehicle operation; and,
- Monitoring should occur during at least one test used by EPA for emissions verification—either the HD Federal Test Procedure (FTP) transient cycle, or the Supplementary Emissions Test (SET).[17]

As discussed in more detail in sections II.B through II.D, we are requiring that manufacturers define the monitoring conditions, subject to Administrator approval, for detecting the malfunctions required by this rule. The Administrator would determine if the monitoring conditions proposed by the manufacturer for each monitor abide by the above criteria.

In general, except as noted in sections II.B through II.D, the regulation requires

[16] See proposed § 86.010–18(i)(3)(iii)(E) and compare to the final § 86.010–18(i)(3)(iii)(E).

[17] See 40 CFR part 86, subpart N for details of EPA's test procedures.

each monitor to run at least once per driving cycle in which the applicable monitoring conditions are met. It also requires certain monitors to run continuously throughout the driving cycle. These include a few threshold monitors (e.g., fuel system monitor) and most circuit continuity monitors. While a basic definition of a driving cycle (e.g., from ignition key-on and engine startup to engine shutoff) has been sufficient for passenger cars, the driving habits of many types of vehicles in the heavy-duty industry dictate an alternate definition. Specifically, many heavy-duty operators will start the engine and leave it running for an entire day or, in some cases, even longer. As such, any period of continuous engine-on operation of four hours will be considered a complete driving cycle. A new driving cycle would begin following such a four hour period, regardless of whether or not the engine had been shut down. Thus, the ''clock'' for monitors that are required to run once per driving cycle would be reset to run again (in the same key-on engine start or trip) once the engine has been operated beyond four hours continuously. This would avoid an unnecessary delay in detection of malfunctions simply because the heavy-duty vehicle operator has elected to leave the vehicle running continuously for an entire day or days at a time.

Consistent with our proposal, manufacturers may request Administrator approval to define monitoring conditions that are not encountered during the FTP cycle. In evaluating the manufacturer's request, the Administrator will consider the degree to which the requirement to run during the FTP cycle restricts in-use monitoring, the technical necessity for defining monitoring conditions that are not encountered during the FTP cycle, data and/or an engineering evaluation submitted by the manufacturer which demonstrate that the component/system does not normally function, or monitoring is otherwise not feasible, during the FTP cycle, and, where applicable, the ability of the manufacturer to demonstrate that the monitoring conditions will satisfy the minimum acceptable in-use monitor performance ratio requirement as defined below.

ii. In-Use Performance Tracking Monitoring Conditions

In addition to the general monitoring conditions above, and consistent with our proposal, we are requiring manufacturers to implement software algorithms in the OBD system to individually track and report in-use performance of the following monitors in the standardized format specified in section II.E:

- Diesel NMHC converting catalyst(s)
- Diesel NO_X converting catalyst(s)
- Gasoline catalyst(s)
- Exhaust gas sensor(s)
- Gasoline evaporative system
- Exhaust gas recirculation (EGR) system
- Variable valve timing (VVT) system
- Gasoline secondary air system
- Diesel particulate filter system
- Diesel boost pressure control system
- Diesel NO_X adsorber(s)

The OBD system is not required to track and report in-use performance for monitors other than those specifically identified above.

iii. In-Use Performance Ratio Requirement

We are also requiring manufacturers to define, for all 2013 and subsequent model year engines, monitoring conditions that, in addition to meeting the general monitoring conditions, ensure that certain monitors yield an in-use performance ratio (which monitors and the details that define the performance ratio are defined in section II.E) that meets or exceeds the minimum acceptable in-use monitor performance ratio for in-use vehicles. As proposed, we are requiring a minimum acceptable in-use monitor performance ratio of 0.100 for all monitors specifically required to track in-use performance. This means that the monitors listed in section II.A.3.ii above must run and make valid diagnostic decisions during 10 percent of the vehicle's trips. We intend to work with industry during the initial years of implementation to gather data on in-use performance ratios and may revise this ratio as appropriate depending on what we learn.

Note that manufacturers may not use the calculated ratio (or any element thereof), or any other indication of monitor frequency, as a monitoring condition for a monitor. For example, the manufacturer would not be allowed to use a low ratio to enable more frequent monitoring through diagnostic executive priority or modification of other monitoring conditions, or to use a high ratio to enable less frequent monitoring.

4. Determining the Proper OBD Malfunction Criteria

For determining the malfunction criteria for monitors associated with an emissions threshold (see sections II.B and II.C for more on emissions thresholds), we are requiring manufacturers to determine the appropriate emissions test cycle during which their monitors will run. Unlike our proposal, we have removed the requirement that the manufacturer choose the cycle over which the most stringent monitor would result.[18] We have made this change to provide manufacturers the flexibility to develop robust monitors that meet all applicable requirements of the rule rather than requiring the most stringent monitor with disregard for its robustness. That said, the Administrator retains the right to challenge the manufacturer's choice of cycles. While we do not necessarily anticipate challenging a manufacturer's determination of which test cycle to use, the final regulations make clear that the manufacturer should be prepared, perhaps with test data, to justify their determination.

We are eliminating our requirement that, for engines equipped with emission controls that experience infrequent regeneration events (e.g., a DPF and/or a NO_X adsorber), a manufacturer must adjust the emission test results for monitors that are required to indicate a malfunction before emissions exceed a certain emission threshold.[19] For each such monitor, the manufacturer need not adjust the emission result as done in accordance with the provisions of section 86.004–28(i) with the component for which the malfunction criteria are being established having been deteriorated to the malfunction threshold. As proposed, the adjusted emission value would have to have been used for purposes of determining whether or not the applicable emission threshold is exceeded.

As we noted in our proposal, we believe that this adjustment process for monitors of systems that experience infrequent regeneration events makes sense and will result in robust monitors, we also believe that it could prove to be overly burdensome for manufacturers. For example, a NO_X adsorber threshold being evaluated by running an FTP using a ''threshold'' part (i.e., a NO_X adsorber deteriorated such that tailpipe emissions are at the applicable thresholds) may be considered acceptable provided the NO_X adsorber does not regenerate during the test, but it may be considered unacceptable if the NO_X adsorber does happen to regenerate during the test. This could happen because emissions would be expected to increase slightly during the regeneration event thereby causing emissions to be

[18] See proposed § 86.010(f)(1)(i) and compare to final § 86.010–18(f)(1)(i).

[19] See proposed § 86.010–18(f)(2) and compare to final § 86.010–18(f)(2).

slightly above the applicable threshold. This would require the manufacturer to recalibrate the NO_X adsorber monitor to detect at a lower level of deterioration to ensure that a regeneration event would not cause an exceedance of the threshold during an emissions test. After such a recalibration, the emissions occurring during the regeneration event would be lower than before because the new ''threshold'' NO_X adsorber would have a slightly higher conversion efficiency. We are concerned that manufacturers may find themselves in a difficult iterative process calibrating such monitors that, in the end, will not be correspondingly more effective. We discuss this in more detail in our Summary and Analysis of Comments document contained in the docket for this rule.

5. Demonstrating Compliance With CARB Requirements

We did not propose that manufacturers be given the opportunity to demonstrate compliance with CARB OBD requirements for the purpose of satisfying federal OBD. We have long had such a provision in our OBD requirements for under 14,000 pound applications. For the final rule, we have included such a provision but want to make clear that this provision should not be interpreted as meaning that a CARB approval equates to an EPA approval.[20] We believe that CARB OBD requirements will be as stringent if not more so than EPA OBD requirements. As such, should a manufacturer demonstrate, and the Administrator determine, that an OBD system complies with the CARB requirements, it would be acceptable for EPA certification. We believe this will lead to an eventual national program.

6. Temporary Provisions To Address Hardship Due to Unusual Circumstances

We have added a new ''temporary hardship'' provision for the final rule.[21] Under this new provision, EPA may allow a manufacturer to sell non-compliant engines for a short time period provided the Administrator determines that the non-compliance is for reasons outside the manufacturer's control. Examples of such reasons may be fires in manufacturer or supplier plants, or ''acts of God'' such as floods, tornados, or hurricanes that have created unforeseen delays in a manufacturer's ability to comply.

This provision is meant to be used for only a limited time (e.g., one to three months) and permission to use the provision would not be granted for the purpose of delaying implementation for a model year. Further, the provision includes in it an expectation that non-compliances would be corrected as quickly as possible, and we would require that the manufacturer submit a plan detailing how the non-compliances will be corrected. The plan must be submitted in conjunction with any requests to make use of this provision and would be subject to Administrator approval. Note also that we fully intend to enforce the manufacturer's plan to ensure that any engines sold as non-compliant would be corrected.

B. Monitoring Requirements and Timelines for Diesel-Fueled/Compression-Ignition Engines

Table II.B–1 summarizes the diesel fueled compression ignition emissions thresholds at which point a component or system has failed to the point of requiring an illuminated MIL and a stored DTC. Some of these thresholds—specifically, the NO_X aftertreatment and NO_X sensor thresholds for 2010 through 2012—differ from what was proposed. The differences serve to make the OBD threshold less stringent than proposed for the purpose of matching thresholds with technological capabilities.[22] We have also eliminated the NMHC catalyst thresholds. We discuss the reasons for these changes in brief in the sections that follow and in more detail in our Summary and Analysis of Comments document contained in the docket for this rule. More detail regarding the final monitoring requirements, implementation schedules, and liabilities can be found in the sections that follow.

TABLE II.B–1—EMISSIONS THRESHOLDS FOR DIESEL FUELED CI ENGINES OVER 14,000 POUNDS

Component/monitor	MY	NMHC	CO	NO_X	PM
NO_X catalyst system	2010–2012			+0.6	
	2013+			+0.3	
DPF system	2010–2012	2.5x			0.05/+0.04
	2013+	2x			0.05/+0.04
Air-fuel ratio sensors upstream	2010–2012	2.5x	2.5x	+0.3	0.03/+0.02
	2013+	2x	2x	+0.3	0.03/+0.02
Air-fuel ratio sensors downstream	2010–2012	2.5x		+0.3	0.05/+0.04
	2013+	2x		+0.3	0.05/+0.04
NO_X sensors	2010–2012			+0.6	0.05/+0.04
	2013+			+0.3	0.05/+0.04
''Other monitors'' with emissions thresholds (see section II.B)	2010–2012	2.5x	2.5x	+0.3	0.03/+0.02
	2013+	2x	2x	+0.3	0.03/+0.02

Notes: MY = Model Year; 2.5x means a multiple of 2.5 times the applicable emissions standard or family emissions limit (FEL); +0.3 means the standard or FEL plus 0.3; 0.05/+0.04 means an absolute level of 0.05 or an additive level of the standard or FEL plus 0.04, whichever level is higher; not all monitors have emissions thresholds but instead rely on functionality and rationality checks as described in section II.D.4.

There are exceptions to the emissions thresholds shown in Table II.B–1 whereby a manufacturer can demonstrate that emissions do not exceed the threshold even when the component or system is non-functional at which point a functional check would be allowed.

Note that, in general, the monitoring strategies designed to meet the requirements should not involve the alteration of the engine control system or the emissions control system such that tailpipe emissions would increase. We do not want emissions to increase, even for short durations, for the sole purpose of monitoring the systems intended to control emissions. The Administrator will consider such monitoring strategies on a case-by-case

[20] See § 86.010–18(a)(5) which is new in the final regulations. Also see § 86.010–18(m)(3) which is new in the final regulations.

[21] See final § 86.010–18(a)(6).

[22] See proposed § 86.010–18(g), Table 1, and compare to final § 86.010–18(g), Table 1.

basis taking into consideration the emissions impact and duration of the monitoring event. However, much effort has been expended in recent years to minimize engine operation that results in increased emissions and we encourage manufacturers to develop monitoring strategies that do not require alteration of the basic control system.

The remaining discussion in Section II.B focuses solely on changes made to the monitoring requirements for the final rule relative to the proposed rule. We have not restated the rationale for each monitor, the monitoring requirements, or the expected monitoring strategies, etc. For such discussion, we refer the reader to our proposal (72 FR 3200).

1. Fuel System Monitoring

We proposed that fuel system malfunctions related to injection pressure, injection timing, injection quantity, and feedback control be individually detected prior to emissions exceeding the thresholds for ''other monitors.'' Further, we proposed that pressure and feedback related malfunctions be monitored continuously and that quantity and timing related malfunctions be monitored once per trip. For the final rule, we are requiring fuel system monitoring for CI engines be consistent with our proposal with a few exceptions.

We have added a new combined monitor option for fuel injection systems. Under this option, the three discrete malfunction criteria for unit injector systems (pressure, quantity, and timing) may be combined into one malfunction. The two discrete malfunction criteria for common rail systems (quantity and timing) may be combined into one malfunction. If choosing the combined monitoring option on either type system, the manufacturer must demonstrate with data that the combined monitoring strategy can detect a component failure by some combination of the individual monitors, a rationality check between the discrete monitors or the downstream effect of the failed component. For threshold monitoring, the manufacturer is expected to demonstrate with data that the combined monitor correctly detects the operating conditions of the fuel injector and indicates the component malfunction prior to exceeding the threshold level required by the regulation. The intent of the combined monitor is to effectively detect and indicate fuel system injector malfunctions although the direct cause of the failure (quantity, timing and/or pressure) is unknown.

For unit injector fuel systems, the final rule allows the fuel system pressure control, injection quantity, and injection pressure to be monitored using functional checks in lieu of monitoring for conditions that would cause emissions to exceed the OBD thresholds for model years 2010 through 2012. Threshold monitoring on unit injector fuel system injection pressure, quantity and timing will be required for model year 2013 and beyond. For common rail systems, the regulation remains unchanged with threshold detection required for fuel system pressure control, injection quantity, and injection pressure for model years 2010 and beyond.

Regarding monitoring conditions, the final rule remains unchanged on common rail systems from the proposal of once per drive cycle for injection pressure and quantity for model years 2010 to 2012 in addition to constant fuel pressure monitoring. On 2013 and later common rail fuel systems, we are requiring continuous monitoring of pressure control and, in a change from our proposal, injector quantity and injector timing monitoring must be done when conditions are met (rather than once per trip). On unit injector systems for model years 2010 to 2012, the monitors for fuel system pressure control, injection quantity, and injection timing are required once per drive cycle. For model years 2013 and beyond, unit injector systems are required to monitor pressure, injector quantity and injector timing when conditions are met.

We are making these fuel injection system monitoring changes because of the system monitoring capability differences between unit injector and common rail systems, while maintaining the intent of malfunction monitoring to indicate a failed component. We believe that the monitoring strategies manufacturers are expected to use in the interim time frame and future system design will result in robust monitoring of the fuel system without sacrificing malfunction detection. The fuel system strategies based on hardware diverge in model years 2010 to 2012 to account for the monitoring capabilities but again converge in model years 2013 for as much commonality as possible. We discuss our rationale in more detail in our Summary and Analysis document contained in the docket for this rule.

2. Engine Misfire Monitoring

We proposed that, for 2010–2012, a continuous engine misfire be detected during engine idle. For 2013 and later, we proposed that engines equipped with combustion sensors monitor continuously for misfire during the full operating range and detect a malfunction prior to emissions exceeding the thresholds for ''other monitors.''

For the final rule, we have made only one change to the misfire monitoring requirements for CI engines. In the proposal, we stated that, if more than one cylinder is misfiring continuously, a separate DTC must be stored indicating that multiple cylinders are misfiring. In the final rule, we state that, if more than one cylinder is misfiring continuously or if more than one but less than half of the cylinders is misfiring continuously, a separate DTC must be stored indicating that multiple cylinders are misfiring.[23] To make use of this additional provision, the manufacturer must receive Administrator approval. We are making this change because we believe that, for some systems, a perfectly acceptable monitor can be developed without sacrificing malfunction detection.

3. Exhaust Gas Recirculation (EGR) System Monitoring

We proposed that malfunctions of the EGR system related to low flow, high flow, slow response, feedback control, and cooler performance be detected prior to emissions exceeding the thresholds for ''other monitors.'' Further, we proposed that flow and feedback related malfunctions be monitored continuously, response related malfunctions be monitored whenever conditions were met, and that cooler malfunctions be monitored once per trip.

For the final rule, we have not made any changes to the EGR requirements except to provide more clarity to the provisions allowing for temporary disablement of continuous monitoring.[24] This new provision allows the OBD system, with approval, to disable temporarily the EGR system monitor(s) under specific ambient conditions (e.g., when freezing may affect performance of the system) or during specific operating conditions (e.g., transients, extreme low or high flow conditions). Even then, the system must still maintain comprehensive component monitoring as required by the comprehensive component monitoring requirements.[25]

[23] See § 86.010–18(g)(2)(ii)(A) for diesel-fueled engines.

[24] See § 86.010–18(g)(3)(iii)(D) for diesel-fueled engines.

[25] See § 86.010–18(i)(3).

4. Turbo Boost Control System Monitoring

We proposed that malfunctions of the boost control system related to underboost, overboost, variable geometry slow response, feedback control, and undercooling be detected prior to emissions exceeding the thresholds for ‘‘other monitors.’’ Further, we proposed that underboost, overboost, and feedback related malfunctions be monitored continuously, that slow response related malfunctions be monitored whenever conditions were met, and that undercooling related malfunctions be monitored once per trip.

One change we have made to the turbo boost control system monitoring requirements for the final rule is to add the phrase, ‘‘on engines so equipped’’ or equivalent.[26] We have added this phrase to clarify that, for engines that do not control the turbo boost control system as suggested by the proposed requirements the provision would not apply or would apply differently. For example, our proposal required that the OBD system detect when the turbo boost control system was unable to achieve the commanded boost. However, some manufacturers use a system that does not in fact command a particular boost pressure (i.e., it is not a closed loop feedback system). For such systems, the final rule makes clear that the system must detect when the turbo boost control system is unable to achieve the commanded boost, or the expected boost for systems that do not control boost pressure. The change does not impact the intent behind the proposed requirements and only serves to provide clarity to manufacturers. We discuss our rationale in more detail in our Summary and Analysis document contained in the docket for this rule.

We have also made a minor change to the turbo boost monitoring conditions. We have added a provision that provides clarity to the requirement to monitor continuously certain parameters. This provision does not change the intent of the proposed requirement, but only serves to provide clarity to the requirement.[27]

5. Non-Methane Hydrocarbon (NMHC) Converting Catalyst Monitoring

We proposed that malfunctions related to NMHC conversion efficiency be detected prior to emissions exceeding the thresholds for ‘‘NMHC catalyst.’’ We also proposed that, should the NMHC converting catalyst be used to assist other aftertreatment devices, that malfunctions be detected if that assistance is no longer occurring. Further, we proposed that conversion efficiency and aftertreatment assistance be monitoring once per trip.

For the final rule, we have eliminated the OBD thresholds associated with monitoring of NMHC converting catalysts (e.g., the diesel oxidation catalyst, or DOC). We have also eliminated the need to monitor the NMHC converting catalyst's ability to generate the proper feedgas for other aftertreatment devices. We have maintained, as was proposed, the requirements to monitor for some level of NMHC conversion and for the ability to generate and sustain the necessary exotherm for catalysts used as part of the regeneration strategy of other aftertreatment devices.[28] As part of this latter requirement, we have added a provision requiring the OBD system to detect when the NMHC converting catalyst is unable to generate a 100 degree Celsius temperature rise, or to achieve the necessary regeneration temperature, within 60 seconds of initiating a forced regeneration event. Further, the OBD system must detect the inability to sustain the necessary regeneration temperature for the duration of the regeneration event. We have also added a provision that the regeneration system be shut down (i.e., the forced regeneration must be aborted) in the event that the regeneration temperature cannot be attained or sustained. The manufacturer would be allowed to define the monitoring conditions for this monitor to ensure that a robust monitoring event would be possible. This requirement is meant to ensure that NMHC emissions will not be excessive during a prolonged and unsuccessful attempt at generating an exotherm for regeneration. As an alternative, the manufacturer may submit, for Administrator approval, their NMHC catalyst exotherm monitor strategy and, if equivalent in effectiveness, could use that strategy instead of the criteria described here. Lastly, we have added a provision whereby a manufacturer can ‘‘test out’’ of monitoring a NMHC catalyst located downstream of a DPF provided its failure will not cause NMHC emissions to exceed the applicable NMHC standard.

We have made these changes for the final rule because we have been convinced by manufacturers that there exists no robust method of detecting loss of NMHC conversion at the levels required for threshold monitoring. We believe that the primary function of the NMHC catalyst will be exotherm generation which is a monitoring requirement we have maintained and broadened. Further, we believe that the exotherm monitor will also serve to provide the detection of lost NMHC conversion and will do so in a more timely fashion than a direct monitoring of NMHC conversion via exhaust gas sensors since those sensors appear unlikely to be able to detect NMHC conversion loss until it is completely lost. Similar arguments exist for eliminating the feedgas monitoring requirement—we know of no robust method to detect this loss given today's sensor technology. We discuss our rationale in more detail in our Summary and Analysis document contained in the docket for this rule.

6. Selective Catalytic Reduction (SCR) and Lean NO_X Catalyst Monitoring

We proposed that malfunctions related to conversion efficiency, active/intrusive reductant delivery, active/intrusive reductant quantity, active/intrusive reductant quality, and feedback control be detected prior to emissions exceeding the thresholds for ‘‘NO_X catalyst system.’’ Further, we proposed that conversion efficiency and reductant quality be monitored once per trip and that reductant delivery, quantity, and feedback control be monitored continuously.

We have made no changes to the SCR and/or lean NO_X catalyst monitoring requirements relative to our proposal except that we have increased the NO_X threshold at which malfunctions must be detected. We proposed a threshold of the NO_X FEL+0.3 g/bhp-hr and are finalizing a threshold of the NO_X FEL+0.6 g/bhp-hr. This revised threshold applies only to model years 2010 through 2012. As proposed, the threshold for model years 2013 and later remains the NO_X FEL+0.3 g/bhp-hr. We have made this change because the state of NO_X sensor technology expected for the 2010 model year is not sufficient for the proposed threshold. We expect that to improve for model years 2013 and later.[29] We discuss our rationale in more detail in our Summary and Analysis document contained in the docket for this rule.

[26] See § 86.010–18(g)(4)(ii) for diesel-fueled engines.

[27] See § 86.010–18(g)(4)(iii)(D) for diesel-fueled engines.

[28] See § 86.010–18(g)(5) for the final NMHC catalyst requirements for diesel-fueled engines.

[29] Please refer to our Final Technical Support Document contained in the docket for this rule (EPA420–R–08–019, Document ID No. EPA–HQ–OAR–2005–0047–0056) which contains our latest understanding of NO_X sensor technology.

7. NO_X Adsorber System Monitoring

We proposed that malfunctions related to adsorber system capability, active/intrusive reductant delivery, and feedback control be detected prior to emissions exceeding the thresholds for ''NO_X catalyst system.'' Further, we proposed that adsorber capability be monitored once per trip and that reductant delivery and feedback control be monitored continuously.

For the final rule, we have changed nothing with respect to the NO_X adsorber monitoring requirements with the exception of revising the NO_X threshold for model years 2010 through 2012 to the NO_X FEL+0.6 from the NO_X FEL+0.3. We have made this change for the same reasons noted above for SCR monitoring. We discuss our rationale in more detail in our Summary and Analysis document contained in the docket for this rule.

8. Diesel Particulate Filter (DPF) System Monitoring

We proposed that malfunctions related to the DPF filtering performance, regeneration frequency, regeneration completion, NMHC conversion, active/intrusive reductant injection, and feedback control be detected prior to emissions exceeding the thresholds for ''DPF system.'' We also proposed that a missing DPF substrate be detected. Further, we proposed that all of these functions be monitored whenever conditions were met.

For the final rule, we have made two changes to the requirements for monitoring the DPF system. The first change is that we have added to the DPF filtering performance monitoring requirement an optional requirement whereby the OBD system can conduct, in effect, a functional check of the DPF. A system using this approach would be required to detect a change in the pressure drop across the DPF relative to the nominal pressure drop across a clean filter and a properly working device.[30] In effect, if the DPF substrate has been compromised, the failure must be detected if it results in a decrease in the expected pressure drop equal to or greater than a defined level, or detectable change in pressure drop, relative to a clean filter.[31]

We believe that such a requirement is, in effect, the same as a threshold requirement for most DPF systems to be certified in the 2010 through 2012 timeframe. Those systems are expected to use a delta pressure approach to DPF monitoring and we expect that manufacturers will design that monitor to detect the smallest hole feasible which, we believe, will result in a decrease in the expected pressure drop somewhere around the level we are requiring. Manufacturers would then determine the emissions impact associated with that hole and hope that it meets our threshold requirement. If it did not, we would probably certify the system with a deficiency presuming the manufacturer had made a good faith effort at compliance and the monitor met our deficiency requirements.[32] We would not want to refuse to certify it since it would be doing the maximum that the delta pressure approach could feasibly do. We would prefer to certify such a system to the decrease in pressure drop requirement without the deficiency than to certify it to a threshold with a deficiency. In the end, the same monitor is being approved.

Another change we have made is to eliminate the NMHC conversion monitoring over DPFs that have some NMHC conversion capacity.[33] We have eliminated this requirement for the same reasons as noted above for NMHC converting catalyst monitors. Note that we have retained an NMHC threshold for the DPF, but it is referenced in conjunction with the DPF regeneration frequency monitor consistent with our proposal.

Lastly, we have included some new monitoring requirements for those systems certified to our optional backpressure loss provision.[34] An important element of these new monitoring conditions is the distinction between conditions used for malfunction determinations versus subsequent passing determinations. The new provisions allow for a malfunction determination during any successful monitoring event. However, subsequent monitoring events are limited to operation following a successful DPF regeneration. This is to ensure that a confirmed leak will not ''fill up'' with PM and begin to look like an acceptable DPF. If monitoring events were allowed to occur as the leak filled up, the OBD system may inadvertently determine that the DPF substrate was not compromised. Limiting subsequent monitoring events (i.e., those following a malfunction determination) to operation following a complete regeneration of the DPF will ensure that no PM has filled up the crack or hole.

We discuss all of these changes in more detail in our Summary and Analysis of Comments document contained in the docket for this rule.

9. Exhaust Gas Sensor Monitoring

We proposed that malfunctions related to sensor performance be detected prior to emissions exceeding the applicable thresholds. We also proposed that malfunctions related to circuit integrity, feedback functions, monitoring functions, and heater performance and circuit integrity be detected prior to those functions being lost. Further, we proposed that sensor and heater performance be monitored once per trip, that monitoring functionality be monitored whenever conditions were met, and that circuit integrity and feedback functionality be monitored continuously.

For the final rule, we have changed nothing with respect to the exhaust gas sensor monitoring requirements with the exception of revising the NO_X sensor monitor NO_X threshold for model years 2010 through 2012 to the NO_X FEL+0.6 from the NO_X FEL+0.3. We have made this change for the same reasons noted above for the NO_X aftertreatment monitoring requirements. We discuss our rationale in more detail in our Summary and Analysis document contained in the docket for this rule.

C. Monitoring Requirements and Timelines for Gasoline/Spark-Ignition Engines

Table II.C–1 summarizes the gasoline fueled spark ignition emissions thresholds at which point a component or system has failed to the point of requiring an illuminated MIL and a stored DTC.

[30] See § 86.010–18(g)(8)(ii)(A) for diesel-fueled engines.

[31] The detectable change in pressure drop is defined as 0.5 times the observed pressure drop on a nominal, clean filter when operating the engine at the 50% speed, 50% load operating point (as specified in test cycle and procedures for the supplemental emissions test (SET) in § 86.1360–2007.)

[32] See § 86.010–18(n).

[33] See proposed § 86.010–18(g)(8)(ii)(D).

[34] See § 86.010–18(g)(8)(iii) for diesel-fueled engines.

TABLE II.C–1—EMISSIONS THRESHOLDS FOR GASOLINE FUELED SI ENGINES OVER 14,000 POUNDS

Component/monitor	MY	NMHC	CO	NO_X
Catalytic converter system	2010+	1.75x		1.75x
"Other monitors" with emissions thresholds (see section II.C)	2010+	1.5x	1.5x	1.5x
Evaporative emissions control system	2010+	0.150 inch leak.		

Notes: MY=Model Year; 1.75x means a multiple of 1.75 times the applicable emissions standard; not all monitors have emissions thresholds but instead rely on functionality and rationality checks as described in section II.D.4. The evaporative emissions control system threshold is not, technically, an emissions threshold but rather a leak size that must be detected; nonetheless, for ease we refer to this as the threshold.

Everything shown in Table II.C–1 is unchanged from our proposal. In fact, we have made only one change in our requirements specific to gasoline engines relative to our proposal.[35] That change is being made in response to requests from industry that would allow for Administrator approval of misfire monitoring disablement under certain conditions on engines with more than eight cylinders and/or in situations where the manufacturer can demonstrate that the best available monitoring strategy is not able to detect the misfire condition. The change we are making for our final rule is meant to align our disablement allowance, with approval, with similar allowances made in the California regulation.[36]

As proposed, there remain exceptions to the emissions thresholds shown in Table II.C–1 whereby a manufacturer can demonstrate that emissions do not exceed the threshold even when the component or system is non-functional at which point a functional check would be allowed.

Additionally, consistent with our proposal, the final gasoline monitoring requirements for engines over 14,000 pounds mirror those that are already in place for gasoline engines used in vehicles under 14,000 pounds. The HD gasoline industry—General Motors and Ford, as of today[37]—have told us that their preference is to use essentially the same OBD system on their engines used in both under and over 14,000 pound vehicles.[38] In general, we agree with the HD gasoline industry on this issue for three reasons:

- The engines used in vehicles above and below 14,000 pounds are the same which makes it easy for industry to use the same OBD monitors;
- The existing OBD requirements for engines used in vehicles below 14,000 pounds have proven effective; and
- The industry members have more than 10 years experience complying with the OBD requirements for engines used in vehicles below 14,000 pounds.

As a result, our final requirements should allow for OBD system consistency in vehicles under and over 14,000 pounds rather than mirroring the HD diesel requirements discussed in section II.B. Nonetheless, the final requirements are for engine-based OBD monitors only rather than monitors for the entire powertrain (which would include the transmission). We are doing this for the same reasons as done for the diesel OBD requirements in that certification of gasoline applications over 14,000 pounds, like their diesel counterparts, is done on an engine basis and not a vehicle basis.

D. Monitoring Requirements and Timelines for Other Diesel and Gasoline Systems

1. Variable Valve Timing and/or Control (VVT) System Monitoring

We proposed that VVT system malfunctions related to achieving the commanded valve timing and/or control within a crank angle and/or lift tolerance and slow system response be detected prior to emissions exceeding the thresholds for ''other monitors.'' Further, we proposed that these malfunctions be monitored whenever conditions were met rather than once per trip.

The final requirements for VVT system monitoring are identical to the proposed requirements.[39]

2. Engine Cooling System Monitoring

We proposed that cooling system malfunctions related to proper thermostat function and engine coolant temperature (ECT) sensor readings be detected. Further, we proposed that malfunctions tied to the thermostat be monitored once per trip and that most ECT malfunctions be monitored once per trip except that circuit malfunctions must be monitored continuously.

For the final rule, we have changed the requirement surrounding the need to detect when the coolant temperature does not warm up to within 20 degrees F of the nominal thermostat regulating temperature. This change allows the OBD system to use a lower temperature (lower than 20 degrees below the nominal regulating temperature) provided the ambient temperature is between 20 degrees F and 50 degrees F. To do so, the manufacturer must present data justifying the new temperature to be reached at the lower ambient temperatures.[40]

3. Crankcase Ventilation System Monitoring

We proposed that the OBD system monitor the CV system on engines so equipped for system integrity. For diesel engines, we proposed that the manufacturer submit a plan for Administrator approval prior to OBD certification that describes the monitoring strategy, malfunction criteria, and monitoring conditions for CV system monitoring. Further, we proposed that the manufacturer may forego monitoring for a disconnection between the crankcase and the CV valve provided the CV system is designed such that it uses tubing connections between the CV valve and the crankcase that are resistant to failure. We also proposed that the manufacturer may forego monitoring for a disconnection between the CV valve and the intake manifold provided the CV system is designed such that any disconnection either causes the engine to stall immediately during idle operation, or is unlikely to occur due to a CV system design that is integral to the induction system (e.g., machined passages rather than tubing or hoses).

The final requirements for crankcase ventilation system monitoring are

[35] There are some changes discussed in section II.D that pertain to both gasoline and diesel applications.

[36] See CCR 1971.1(f)(2.3.4)(D) and CCR 1971.1(f)(2.3.5) and compare to § 86.010–18(h)(2)(iii)(D) and § 86.010(h)(2)(iii)(E), respectively.

[37] This is true according to our certification database for the 2004, 2005, and 2006 model years. Other manufacturers certify engines that use the Otto cycle, but those engines do not burn gasoline and instead burn various alternative fuels.

[38] ''EMA Comments on Proposed HDOBD Requirements for HDGE,'' bullet items 3 and 4; April 28, 2005, Docket ID# EPA–HQ–OAR–2005–0047–0003.

[39] See § 86.010–18(g)(10) for diesel-fueled engines and § 86.010–18(h)(9) for gasoline-fueled engines.

[40] See § 86.010–18(i)(1) for the final cooling system monitoring requirements.

identical to the proposed requirements.[41]

4. Comprehensive Component Monitors

We proposed that, in general, the OBD system must detect a malfunction of any electronic engine component or system that either provides input to or receives commands from the onboard computer(s). Further, we proposed that malfunctions related to circuit continuity and/or out-of-range values be monitored continuously and that malfunctions related to input data rationality and/or output component functional response be monitored whenever conditions were met.

For the final rule, we have made several changes to the proposed requirements for comprehensive component monitoring. The first of those changes is to revise the provisions concerning the emission effect that determines what must be monitored as a comprehensive component. In the proposed rule, we provided a general set of parameters that fit within the comprehensive component concept. For example, components that provide input to or received commands from the engine computer along with specific examples of such components.[42] We then stated that any such component that could effect emissions over any reasonable driving condition must be monitored. For the final rule, we have changed these emission impacts slightly by stating that any such component that could cause emissions to exceed emissions standards must be monitored.[43] We have made this change because we believe it to be consistent with the Clean Air Act which states that OBD systems should monitor components that could cause or result in failure of the vehicles to comply with emission standards established for such vehicles (see Section I.C.3 above).

The second change we have made to the comprehensive component monitoring requirements is the change to the MIL circuit check and the wait-to-start lamp circuit check. These changes were discussed in Section II.A.2 above.

We have also changed the requirements for monitoring of glow plugs in the 2010 through 2012 model years. During those model years, glow plugs must be monitored for circuit checks only. For model years 2013 and later, we have not made any changes to our proposal (functional checks must be done).[44] We are making this change for the 2010 through 2012 model years because we do not believe that the time available for 2010 implementation is sufficient for all manufacturers to make the changes necessary to conduct functional checks, but we believe that such checks are important and should be done for 2013 and later.

5. Other Emissions Control System Monitoring

We proposed monitoring of other emission control systems that are not otherwise specifically addressed and that the manufacturer submit a plan for Administrator approval of the monitoring strategy, malfunction criteria, and monitoring conditions prior to introduction on a production engine.

The final requirements for other emission control system monitoring are identical to the proposed requirements.

6. Exceptions to Monitoring Requirements

We proposed that certain monitors could be disabled under specific conditions related generally to ambient conditions. Further, we proposed that most such disablements be approved by the Administrator.

The final requirements for exceptions to monitoring are identical to the proposed requirements.

E. A Standardized Method To Measure Real World Monitoring Performance

As was noted in section II.A.3, manufacturers determine the most appropriate times to run the non-continuous OBD monitors. This way, they are able to make their OBD evaluation either at the operating condition when an emissions control system is active and its operational status can best be evaluated, and/or at the operating condition when the most accurate evaluation can be made (e.g., highly transient conditions or extreme conditions can make evaluation difficult). Importantly, manufacturers are prohibited from using a monitoring strategy that is so restrictive such that it rarely or never runs. To help protect against monitors that rarely run, we proposed an ''in-use monitor performance ratio'' requirement. The final rule contains the same requirement without changes.[45]

The set of operating conditions that must be met so that an OBD monitor can run are called the ''enable criteria'' for that given monitor. These enable criteria are often different for different monitors and may well be different for different types of engines. A large diesel engine intended for use in a Class 8 truck would be expected to see long periods of relatively steady-state operation while a smaller engine intended for use in an urban delivery truck would be expected to see a lot of transient operation. Manufacturers will need to balance between a rather loose set of enable criteria for their engines and vehicles given the very broad range of operation HD highway engines see and a tight set of enable criteria given the desire for greater monitor accuracy. Manufacturers would be required to design these enable criteria so that the monitor:

- Is robust (i.e., accurate at making pass/fail decisions);
- Runs frequently in the real world; and
- In general, also runs during the FTP heavy-duty transient cycle.

If designed incorrectly, these enable criteria may be either too broad and result in inaccurate monitors, or overly restrictive thereby preventing the monitor from executing frequently in the real world.

Since the primary purpose of an OBD system is to monitor for and detect emission-related malfunctions while the engine is operating in the real world, a standardized methodology for quantifying real world performance would be beneficial to both EPA and manufacturers. Generally, in determining whether a manufacturer's monitoring conditions are sufficient, a manufacturer would discuss the proposed monitoring conditions with EPA staff. The finalized conditions would be included in the certification applications and submitted to EPA staff who would review the conditions and make determinations on a case-by-case basis based on the engineering judgment of the staff. In cases where we are concerned that the documented conditions may not be met during reasonable in-use driving conditions, we would most likely ask the manufacturer for data or other engineering analyses used by the manufacturer to determine that the conditions would occur in-use. In requiring a standardized methodology for quantifying real world performance, we believe this review process can be done more efficiently than would occur otherwise. Furthermore, it would serve to ensure that all manufacturers are held to the same standard for real world performance. Lastly, we want review procedures that will ensure that monitors operate properly and frequently in the field.

[41] See § 86.010–18(i)(2) for the final CV system monitoring requirements.

[42] See proposed and/or final § 86.010–18(i)(3)(i).

[43] See final § 86.010–18(i)(3)(i)(A) and compare to proposed § 86.010–18(i)(3)(i)(A).

[44] See § 86.010–18(i)(3)(iii)(D).

[45] This requirement can be found in § 86.010–18(d).

Therefore, manufacturers will be required to use a standardized method for determining real world monitoring performance and will be liable if monitoring occurs less frequently than a minimum acceptable level, expressed as minimum acceptable in-use performance ratio.[46] We are also requiring that manufacturers implement software in the onboard computer to track how often several of the major monitors (e.g., catalyst, EGR, CDPF, other diesel aftertreatment devices) execute during real world driving. The onboard computer must keep track of how many times each of these monitors has executed and how much the engine has been operated. By measuring both of these values, the ratio of monitor operation relative to engine operation can be calculated to determine monitoring frequency.

The minimum acceptable frequency requirement will apply to many but not all of the OBD monitors. We are requiring that monitors operate either continuously, once per drive cycle, or, in a few cases, multiple times per drive cycle (i.e., whenever the proper monitoring conditions are present). For components or systems that are more likely to experience intermittent failures or failures that can routinely happen in distinct portions of an engine's operating range (e.g., only at high engine speed and load, only when the engine is cold or hot), monitors are required to operate continuously. Examples of continuous monitors include most electrical/circuit continuity monitors. For components or systems that are less likely to experience intermittent failures or failures that only occur in specific vehicle operating regions or for components or systems where accurate monitoring can only be performed under limited operating conditions, monitors would be required to run once per drive cycle. Examples of once per drive cycle monitors typically include gasoline catalyst monitors, evaporative system leak detection monitors, and output comprehensive component functional monitors. For components or systems that are routinely used to perform functions that are crucial to maintaining low emissions but may still require monitoring under fairly limited conditions, monitors are required to run each and every time the manufacturer-defined enable conditions are present. Examples of multiple times per drive cycle monitors typically include input comprehensive component rationality monitors and some exhaust aftertreatment monitors.

Monitors required to run continuously, by definition, would always be running thereby making a minimum frequency requirement moot. The new frequency requirement essentially applies only to those monitors that are designated as once per drive cycle or multiple times per drive cycle monitors. For all of these monitors, manufacturers are required to define monitoring conditions that ensure adequate frequency in-use. Specifically, the monitors need to run often enough so that the measured monitor frequency on in-use engines will exceed the minimum acceptable frequency. However, even though the minimum frequency requirement applies to nearly all once per drive cycle and multiple times per drive cycle monitors, manufacturers are only required to implement software to track and report the in-use frequency for a few of the major monitors. These few monitors generally represent the major emissions control components and the ones with the most limited enable criteria.

We believe that OBD monitors should run frequently to ensure early detection of emissions-related malfunctions and, consequently, to maintain low emissions. Allowing malfunctions to continue undetected and unrepaired for long periods of time allows emissions to increase unnecessarily. Frequent monitoring can also help to ensure detection of intermittent emissions-related malfunctions (i.e., those that are not continuously present but occur sporadically for days and even weeks at a time). The nature of mechanical and electrical systems is that intermittent malfunctions can and do occur. The less frequent the monitoring, the less likely these malfunctions will be detected and repaired. Additionally, for both intermittent and continuous malfunctions, earlier detection is equivalent to preventative maintenance in that the original malfunction can be detected and repaired prior to it causing subsequent damage to other components. This can help vehicle operators avoid more costly repairs that could have resulted had the first malfunction gone undetected.

Infrequent monitoring can also have an impact on the service and repair industry. Specifically, monitors that have unreasonable or overly restrictive enable conditions could hinder vehicle repair services. In general, upon completing an OBD-related repair to an engine, a technician will attempt to verify that the repair has indeed fixed the problem. Ideally, a technician will operate the vehicle in a manner that will exercise the appropriate OBD monitor and allow the OBD system to confirm that the malfunction is no longer present. This affords a technician the highest level of assurance that the repair was indeed successful. However, OBD monitors that operate infrequently are difficult to exercise and, therefore, technicians may not be able (or may not be likely) to perform such post-repair evaluations. Despite the service information availability requirements we are promulgating—requirements that manufacturers make all of their service and repair information available to all technicians, including the information necessary to exercise OBD monitors—technicians would still find it difficult to exercise monitors that require infrequently encountered engine operating conditions (e.g., abnormally steady constant speed operation for an extended period of time). Additionally, to execute OBD monitors in an expeditious manner or to execute monitors that would require unusual or infrequently encountered conditions, technicians may be required to operate the vehicle in an unsafe manner (e.g., at freeway speeds on residential streets or during heavy traffic). If unsuccessful in executing these monitors, technicians may even take shortcuts in attempting to validate the repair while maintaining a reasonable cost for customers. These shortcuts would likely not be as thorough in verifying repairs and could increase the chance that improperly repaired engines would be returned to the vehicle owner or additional repairs would be performed just to ensure the problem is fixed. In the end, monitors that operate less frequently can result in unnecessary costs and inconvenience to both vehicle owners and technicians.

1. Description of Software Counters To Track Real World Performance

As stated above, manufacturers are required to track monitor performance by comparing the number of monitoring events (i.e., how often each monitor has run) to the number of driving events (i.e., how often has the vehicle been operated). Our final rule contains this requirement as did our proposal. In general, we have not changed the requirements associated with determination of this minimum performance ratio. However, we have made some minor changes.

The first of these is the way in which the denominator of the ratio is determined for diesel engines. The ratio

[46] This minimum acceptable ratio applies in model years 2013 and later, as was proposed.

of these two numbers would give an indication of how often the monitor is operating relative to vehicle operation. In equation form, this can be stated as:

$$\text{In-Use Performance (Ratio)} = \frac{\text{Number of Monitoring Events (Numerator)}}{\text{Number of Driving Events (Denominator)}}$$

Specifically, we have changed the denominator provisions which stated that the denominator would be incremented if, on a single key start, the following criteria were satisfied while ambient temperature remained above 20 degrees Fahrenheit and altitude remained below 8,000 feet:

- Minimum engine run time of 10 minutes;
- Minimum of 5 minutes, cumulatively, of operation at vehicle speeds greater than 25 miles-per-hour for gasoline engines or calculated load greater than 15 percent for diesel engines; and
- At least one continuous idle for a minimum of 30 seconds encountered.

For the final rule, the second bullet has been changed to read:

- Minimum of 5 minutes, cumulatively, of operation at vehicle speeds greater than 25 miles-per-hour for gasoline engines or engine speeds greater than 1,150 rotations per minute (RPM) for diesel engines. We are also allowing diesel engines to employ the gasoline criteria for the years 2010 through 2012 but not thereafter.[47]

We have made this change because we believe that the 1,150 RPM criterion is a better measure of work than the 15% load criterion. The purpose of the time at load (i.e., 5 minutes of engine load above 15%) was to have criteria that would represent that an engine had been doing work for at least 5 minutes (300 seconds). After consideration, we have decided that engine speed above 1,150 RPM for 5 minutes is a better measure of engine work.

2. Performance Tracking Requirements

a. In-Use Monitoring Performance Ratio Definition

For monitors required to meet the in-use performance tracking requirements,[48] we are requiring that the incrementing of numerators and denominators and the calculation of the in-use performance ratio be done in accordance with the following specifications. These specifications have not changed from the proposal.

The numerator(s) are defined as a measure of the number of times a vehicle has been operated such that all monitoring conditions necessary for a specific monitor to detect a malfunction have been encountered. Except for systems using alternative statistical MIL illumination protocols, the numerator is to be incremented by an integer of one. The numerator(s) may not be incremented more than once per drive cycle. The numerator(s) for a specific monitor would be incremented within 10 seconds if and only if the following criteria are satisfied on a single drive cycle:

- Every monitoring condition necessary for the monitor of the specific component to detect a malfunction and store a pending DTC has been satisfied, including enable criteria, presence or absence of related DTCs, sufficient length of monitoring time, and diagnostic executive priority assignments (e.g., diagnostic ''A'' must execute prior to diagnostic ''B''). For the purpose of incrementing the numerator, satisfying all the monitoring conditions necessary for a monitor to determine that the component is passing may not, by itself, be sufficient to meet this criteria.
- For monitors that require multiple stages or events in a single drive cycle to detect a malfunction, every monitoring condition necessary for all events to have completed must be satisfied.
- For monitors that require intrusive operation of components to detect a malfunction, a manufacturer would be required to request Administrator approval of the strategy used to determine that, had a malfunction been present, the monitor would have detected the malfunction. Administrator approval of the request would be based on the equivalence of the strategy to actual intrusive operation and the ability of the strategy to determine accurately if every monitoring condition was satisfied as necessary for the intrusive event to occur.
- For the secondary air system monitor, the three criteria above are satisfied during normal operation of the secondary air system. Monitoring during intrusive operation of the secondary air system later in the same drive cycle solely for the purpose of monitoring may not, by itself, be sufficient to meet these criteria.

The third bullet item above requires explanation. There may be monitors designed to use what could be termed a two stage or two step process. The first step is usually a passive and/or short evaluation that can be used to ''pass'' a properly working component where ''pass'' refers to evaluating the component and determining that it is not malfunctioning. The second step is usually an intrusive and/or longer evaluation that is necessary to ''fail'' a malfunctioning component or ''pass'' a component nearing the point of failure. An example of such an approach might be an evaporative leak detection monitor that uses an intrusive vacuum pull-down/bleed-up evaluation during highway cruise conditions. If the evaporative system is sealed tight, the monitor ''passes'' and is done with testing for the given drive cycle. If the monitor senses a leak close to the required detection limit, the monitor does not ''pass'' and an internal flag is stored that will trigger the second stage of the test during the next cold start when a more accurate evaluation can be conducted. On the next cold start, provided the internal flag is set, an intrusive vacuum pull-down/bleed up monitor might be conducted during engine idle a very short time after the cold start. This second evaluation stage, being at idle and cold, gives a more accurate indication of the evaporative system's integrity and provides for a more accurate decision regarding the presence and size of a leak.

In this example, the second stage of this monitor would run less frequently in real use than the first stage since it is activated only on those occasions where the first stage suggests that a leak may be present (which most cars will not have). The rate-based tracking requirements are meant to give a measure of how often a monitor could detect a malfunction. To know the right answer, we need to know how often the first stage is running and could ''fail'', thus triggering the second stage, and then how often the second stage is completing. If we track only the first stage, we would get a false indication of

[47] See § 86.010–18(d)(4).

[48] These monitors, as presented in section II.A.3 (also see 86.010–18(e)(1)), are, for diesel engines: The NMHC catalyst, the CDPF system, the NO_X adsorber system, the NO_X converting catalyst system, and the boost system; and, for gasoline engines: The catalyst, the evaporative system, and the secondary air system; and, for all engines, the exhaust gas sensors, the EGR system, and the VVT system.

how often the monitor could really detect a leak. But, if we track only the second stage, most cars would never increment the counter since most cars do not have leaks and would not trigger stage two.

In considering this, we see two possible solutions: (1) Always activate the second stage evaluation in which case there would be an intrusive monitor being performed that does not really need to be performed; or, (2) implement a ''ghost'' monitor that pretends that the first stage evaluation triggers the second stage evaluation and then also looks for when the second stage evaluation could have completed had it been necessary. The third bullet item in the list above requires that, if a manufacturer intends to implement a two stage monitor and intends to implement such a ''ghost'' monitor as described here for rate based tracking, great care must be taken to ensure that it is being done correctly and properly.

For monitors that can generate results in a ''gray zone'' or ''non-detection zone'' (i.e., results that indicate neither a passing system nor a malfunctioning system) or in a ''non-decision zone'' (e.g., monitors that increment and decrement counters until a pass or fail threshold is reached), the manufacturer is responsible for incrementing the numerator appropriately. In general, the numerator should not be incremented when the monitor indicates a result in the ''non-detection zone'' or prior to the monitor reaching a decision. When necessary, the manufacturer will be expected to have data and/or engineering analyses demonstrating the expected frequency of results in the ''non-detection zone'' and the ability of the monitor to determine accurately, had an actual malfunction been present, whether or not the monitor would have detected a malfunction instead of a result in the ''non-detection zone.'' [49]

For monitors that run or complete their evaluation with the engine off, the numerator must be incremented either within 10 seconds of the monitor completing its evaluation in the engine off state, or during the first 10 seconds of engine start on the subsequent drive cycle.

Manufacturers using alternative statistical MIL illumination protocols for any of the monitors that require a numerator would be required to increment the numerator(s) appropriately. The manufacturer may be required to provide supporting data and/or engineering analyses demonstrating both the equivalence of their incrementing approach to the incrementing specified above for monitors using the standard MIL illumination protocol, and the overall equivalence of their incrementing approach in determining that the minimum acceptable in-use performance ratio has been satisfied.

Regarding the denominator(s), defined as a measure of the number of times a vehicle has been operated, we are requiring that it also be incremented by an integer of one.[50] The denominator(s) may not be incremented more than once per drive cycle. The general denominator and the denominators for each monitor would be incremented within 10 seconds if and only if the following criteria are satisfied on a single drive cycle during which ambient temperature remained at or above 20 degrees Fahrenheit and altitude remained below 8,000 feet:

- Cumulative time since the start of the drive cycle is greater than or equal to 600 seconds (10 minutes);
- Cumulative gasoline engine operation at or above 25 miles per hour or diesel engine operation at or above 1,150 RPM, either of which occurs for greater than or equal to 300 seconds (5 minutes); and
- Continuous engine operation at idle (e.g., accelerator pedal released by the driver, engine speed less than or equal to 200 rpm above normal warmed-up idle or vehicle speed less than or equal to one mile per hour) for greater than or equal to 30 seconds.

In addition to the requirements above, the evaporative system monitor denominator(s) must be incremented if and only if:

- Cumulative time since the start of the drive cycle is greater than or equal to 600 seconds (10 minutes) while at an ambient temperature of greater than or equal to 40 degrees Fahrenheit but less than or equal to 95 degrees Fahrenheit; and
- Engine cold start occurs with engine coolant temperature at engine start greater than or equal to 40 degrees Fahrenheit but less than or equal to 95 degrees Fahrenheit and less than or equal to 12 degrees Fahrenheit higher than ambient temperature at engine start.

In addition to the requirements above, the denominator(s) for the following monitors must be incremented if and only if the component or strategy is commanded ''on'' for a time greater than or equal to 10 seconds:

- Gasoline secondary air system;
- Cold start emission reduction strategy;
- Components or systems that operate only at engine start-up (e.g., glow plugs, intake air heaters) and are subject to monitoring under ''other emission control systems'' or comprehensive component output components.

For purposes of determining this commanded ''on'' time, the OBD system may not include time during intrusive operation of any of the components or strategies later in the same drive cycle solely for the purposes of monitoring.

In addition to the requirements above, the denominator(s) for the monitors of the following output components (except those operated only at engine start-up as outlined above) must be incremented if and only if the component is commanded to function (e.g., commanded ''on'', ''open'', ''closed'', ''locked'') two or more times during the drive cycle or for a time greater than or equal to 10 seconds, whichever occurs first:

- Variable valve timing and/or control system
- ''Other emission control systems''
- Comprehensive component (output component only, e.g., turbocharger waste-gates, variable length manifold runners)

For monitors of the following components, the manufacturer may use alternative or additional criteria to that set forth above for incrementing the denominator. To do so, the manufacturer would need to be able to demonstrate that the criteria would be equivalent to the criteria outlined above at measuring the frequency of monitor operation relative to the amount of engine operation:

- Engine cooling system input components
- ''Other emission control systems''
- Comprehensive component input components that require extended monitoring evaluation (e.g., stuck fuel level sensor rationality), and temperature sensor rationality monitors
- DPF regeneration frequency

For monitors of the following components or other emission controls that experience infrequent regeneration events, the manufacturer may use alternative or additional criteria to that set forth above for incrementing the denominator. To do so, the manufacturer would need to ensure that the criteria would be equivalent to the criteria outlined above at measuring the frequency of monitor operation relative to the amount of engine operation:

- NMHC converting catalysts
- Diesel particulate filters

For hybrid engine systems, engines that employ alternative engine start hardware or strategies (e.g., integrated starter and generators), or alternative

[49] See 86.010–18(d)(3)(iii).

[50] See 86.010–18(d)(4) for details on the denominator.

fueled engines (e.g., dedicated, bi-fuel, or dual-fuel applications), the manufacturer may request Administrator approval to use alternative criteria to that set forth above for incrementing the denominator. In general, approval would not be given for alternative criteria that only employ engine shut off at or near idle/vehicle stationary conditions. Approval of the alternative criteria would be based on the equivalence of the alternative criteria at determining the amount of engine operation relative to the measure of conventional engine operation in accordance with the criteria above.

The numerators and denominators may need to be disabled at some times.[51] To do this, within 10 seconds of a malfunction being detected (i.e., a pending, MIL-on, or active DTC being stored) that disables a monitor required to meet the performance tracking requirements,[52] the OBD system must disable further incrementing of the corresponding numerator and denominator for each monitor that is disabled. When the malfunction is no longer detected (e.g., the pending DTC is erased through self-clearing or through a scan tool command), incrementing of all corresponding numerators and denominators should resume within 10 seconds. Also, within 10 seconds of the start of a power takeoff unit (PTO) that disables a monitor required to meet the performance tracking requirements, the OBD system should disable further incrementing of the corresponding numerator and denominator for each monitor that is disabled. When the PTO operation ends, incrementing of all corresponding numerators and denominators should resume within 10 seconds. The OBD system must disable further incrementing of all numerators and denominators within 10 seconds if a malfunction has been detected in any component used to determine if: Vehicle speed/calculated load; ambient temperature; elevation; idle operation; engine cold start; or, time of operation has been satisfied, and the corresponding pending DTC has been stored. Incrementing of all numerators and denominators should resume within 10 seconds when the malfunction is no longer present (e.g., pending DTC erased through self-clearing or by a scan tool command).

The in-use performance monitoring ratio itself is defined as the numerator for the given monitor divided by the denominator for that monitor.

b. Standardized Tracking and Reporting of Monitor Performance

Consistent with our proposal, we are requiring that the OBD system separately report an in-use monitor performance numerator and denominator for each of the following components:[53]

- For diesel engines: NMHC catalyst bank 1, NMHC catalyst bank 2, NO_X catalyst bank 1, NO_X catalyst bank 2, exhaust gas sensor bank 1, exhaust gas sensor bank 2, EGR/VVT system, DPF system, turbo boost control system, and the NO_X adsorber. The OBD system must also report a general denominator and an ignition cycle counter in the standardized format discussed below and in section II.F.5.
- For gasoline engines: catalyst bank 1, catalyst bank 2, oxygen sensor bank 1, oxygen sensor bank 2, evaporative leak detection system, EGR/VVT system, and secondary air system. The OBD system must also report a general denominator and an ignition cycle counter in the standardized format specified below and in section II.F.5.

The OBD system will be required to report a separate numerator for each of the components listed in the above bullet lists. For specific components or systems that have multiple monitors that are required to be reported—e.g., exhaust gas sensor bank 1 may have multiple monitors for sensor response or other sensor characteristics—the OBD system should separately track numerators and denominators for each of the specific monitors and report only the corresponding numerator and denominator for the specific monitor that has the lowest numerical ratio. If two or more specific monitors have identical ratios, the corresponding numerator and denominator for the specific monitor that has the highest denominator should be reported for the specific component. The numerator(s) must be reported as discussed in section II.F.5.[54]

The OBD system will also be required to report a separate denominator for each of the components listed in the above bullet lists. The denominator(s) must be reported as discussed in section II.F.5.[55]

Similarly, for the in-use performance ratio, determining which corresponding numerator and denominator to report as required for specific components or systems that have multiple monitors that are required to be reported—e.g., exhaust gas sensor bank 1 may have multiple monitors for sensor response or other sensor characteristics—the ratio should be calculated as discussed in section II.F.5.[56]

The ignition cycle counter is defined as a counter that indicates the number of ignition cycles a vehicle has experienced. The ignition cycle counter must also be reported as discussed in section II.F.5.[57] The ignition cycle counter, when incremented, should be incremented by an integer of one. The ignition cycle counter may not be incremented more than once per ignition cycle. The ignition cycle counter should be incremented within 10 seconds if and only if the engine exceeds an engine speed of 50 to 150 rpm below the normal, warmed-up idle speed (as determined in the drive position for vehicles equipped with an automatic transmission) for at least two seconds plus or minus one second. The OBD system should disable further incrementing of the ignition cycle counter within 10 seconds if a malfunction has been detected in any component used to determine if engine speed or time of operation has been satisfied and the corresponding pending DTC has been stored. The ignition cycle counter may not be disabled from incrementing for any other condition. Incrementing of the ignition cycle counter should resume within 10 seconds after the malfunction is no longer present (e.g., pending DTC erased through self-clearing or by a scan tool command).

F. Standardization Requirements

Consistent with our proposal, the final regulation includes requirements for manufacturers to standardize certain features of the OBD system.[58] Effective standardization assists all repair technicians in diagnosing and repairing malfunctions by providing equal access to essential repair information, and requires structuring the information in a common format from manufacturer to manufacturer. Additionally, the standardization will help to facilitate the potential use of OBD checks in heavy-duty inspection and maintenance programs.

The features that will be standardized include:

[51] See 86.010–18(d)(5).

[52] These monitors, as presented in section II.A.3, are, for diesel engines: the NMHC catalyst, the CDPF system, the NO_X adsorber system, the NO_X converting catalyst system, and the boost system; and, for gasoline engines: the catalyst, the evaporative system, and the secondary air system; and, for all engines, the exhaust gas sensors, the EGR system, and the VVT system.

[53] See § 86.010–18(e)(1).

[54] See § 86.010–18(e)(2).

[55] See § 86.010–18(e)(3).

[56] See § 86.010–18(e)(4).

[57] See § 86.010–18(e)(5).

[58] See § 86.010–18(k).

• The diagnostic connector, the computer communication protocol (beginning in model year 2013 as we proposed);
• The hardware and software specifications for tools used by service technicians;
• The information communicated by the onboard computer and the methods for accessing that information;
• The numeric designation of the DTCs stored when a malfunction is detected; and
• The terminology used by manufacturers in their service manuals.

Also consistent with our proposal, only a certain minimum set of emissions-related information must be made available through the standardized format, protocol, and connector. We are not limiting engine manufacturers as to what protocol they use for engine control, communication between onboard computers, or communication to manufacturer-specific scan tools or test equipment. Further, we are not prohibiting engine manufacturers from equipping the vehicle with additional diagnostic connectors or protocols as required by other suppliers or purchasers. For example, fleets that use data logging or other equipment that requires the use of SAE J1587 communication and connectors could still be installed and supported by the engine and vehicle manufacturers. The OBD rules only require that engine manufacturers also equip their vehicles with a specific connector and communication protocol that meet the standardized requirements to communicate a minimum set of emissions-related diagnostic, service and, potentially, inspection information.

1. Reference Documents

We are requiring that OBD systems comply with the provisions laid out in certain Society of Automotive Engineers (SAE) and/or International Organization of Standards (ISO) documents that are incorporated by reference (IBR) into federal regulation. Details regarding these SAE and ISO documents can be found in § 86.1(b) and in § 86.010–18(k).

Notably, we are requiring that OBD systems on engines placed in over 14,000 pound vehicles use either the SAE J1939 or the ISO 15765–4:2005(E) communication protocols. Note that some manufacturers have expressed interest in the ISO 27145 standard. As of this writing, that standard is not available. Should it become available in time for model year 2013 and later implementation, we will consider allowing that standard and may issue a technical amendment, direct final rule, or proposed rule to address it.

2. Diagnostic Connector Requirements

We have made no substantive changes relative to our proposal with respect to the diagnostic data link connector. The one change we have made is simply to allow the Administrator to approve alternative locations for the connector. We have made this change to accommodate certain applications such as buses in which the required location would not work well. Note that the requirements for model years 2013 and later now appear in § 86.010–18 rather than § 86.013–18 as in our proposal.[59]

3. Communications to a Scan Tool

In light-duty OBD, manufacturers are allowed to use one of four protocols for communication between a generic scan tool and the vehicle's onboard computer. A generic scan tool automatically cycles through each of the allowable protocols until it hits upon the proper one with which to establish communication with the particular onboard computer. While this has generally worked successfully in the field, some communication problems have arisen.

In an effort to address these problems, CARB has made recent changes to their light-duty OBDII regulation that require all light-duty vehicle manufacturers to use only one communication protocol by the 2008 model year. In making these changes, CARB staff argued that their experience with standardization under the OBD II regulation showed that having a single set of standards used by all vehicles would be desirable. CARB staff argued that a single protocol offers a tremendous benefit to both scan tool designers and service technicians. Scan tool designers could focus on added feature content and could expend much less time and money validating basic functionality of their product on all the various permutations of protocol interpretations that are implemented. In turn, technicians would likely get a scan tool that works properly on all vehicles without the need for repeated software updates that incorporate ''work-arounds'' or other patches to fix bugs or adapt the tool to accommodate slight variances in how the multiple protocols interact with each other or are implemented by various manufacturers. Further, a single protocol should also be beneficial to fleet operators that use add-on equipment such as data loggers, and for vehicle manufacturers that integrate parts from various engine and component suppliers all of which must work together.

[59] See proposed §§ 86.010–18(k)(2) and 86.013–18(k)(2) and compare to final § 86.010–18(k)(2).

Based on our similar experiences at the federal level with communication protocols giving rise to service and inspection/maintenance program issues, we initially wanted to propose a single communication protocol for engines used in over 14,000 pound vehicles. However, the affected industry has been divided over which single protocol should be required and has strongly argued for more than one protocol to be allowed. Therefore, for vehicles with diesel engines, we proposed and are allowing manufacturers use either the standards set forth in SAE J1939, or those set forth in the 500 kbps baud rate version of ISO 15765. For vehicles with gasoline engines, we are requiring that manufacturers use the 500 kbps baud rate version of ISO 15765.[60] Manufacturers would be required to use only one standard to meet all the standardization requirements on a single vehicle; that is, a vehicle must use only one protocol for all OBD modules on the vehicle.

As noted above, some manufacturers have expressed interest in the ISO 27145 standard. That standard is being developed as part of the Worldwide Harmonized Heavy-duty OBD global technical regulation (WWH–OBD).[61] As of this writing, that ISO standard is not available. Should it become available in time for model year 2013 and later implementation, we will consider allowing that standard and may issue a technical amendment, direct final rule, or proposed rule to address it.

4. Required Emissions Related Functions

We have made only a few changes in the final rule relative to our proposal. We believe that all of these changes are minor and serve to ease the burden on manufacturers without sacrificing our OBD program. The first change is that made to the permanent DTC erasure provisions.[62] The final provisions provide more clarity and flexibility to manufacturers in cases where stored DTC information has been erased via scan tool or battery disconnect. These changes are consistent with changes made to CARB's OBDII regulation in 2007 and changes we believe CARB will make when revising their HDOBD regulation (expected in 2009).

[60] See § 86.010–18(k)(3).

[61] Global Technical Regulation Number 5: Technical Requirements for On-board Diagnostic Systems for Road Vehicles; ECE/TRANS/180/Add.5; 23 January 2007, see *http://www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29glob_registry.html.*

[62] See proposed § 86.010–18(b)(3)(iii) and compare to the final § 86.010–18(b)(3)(iii).

We have also made a slight change to the definition of idle where we require that the OBD system track engine run-time and track the amount of time operating in idle mode. The provision removes the phrase ''vehicle speed less than 1 mph'' and replaces it with ''engine speed less than or equal to 200 rpm above normal warmed-up idle or vehicle speed less than 1 mph.'' We have made this change to be consistent with industry request, and because we believe it does not sacrifice our intent in any way.[63]

We have also made minor changes to the CAL ID and CVN requirements.[64] These changes allow for multiple CAL IDs per diagnostic or emission critical control unit. Our proposal allowed for only one. We would prefer that there be only one for the sake of minimizing confusion. Manufacturers would be required to get Administrator approval to use multiple CAL IDs and would also be required to communicate these to the scan tool in order of priority which should minimize if not eliminate possible confusion. We have made a corresponding change to the CVN requirements for systems using the multiple CAL ID provision.

5. In-Use Performance Ratio Tracking Requirements

To separately report an in-use performance ratio for each applicable monitor as discussed in sections II.B through II.D, we proposed that manufacturers be required to implement software algorithms to report a numerator and denominator in a standardized format. We have made no changes to those requirements in the final rule, with the exception of the minor change to the definition of idle from ''vehicle speed less than one mile per hour'' to ''engine speed less than or equal to 200 rpm above normal warmed-up idle and vehicle speed less than or equal to one mile per hour.'' [65]

6. Exceptions to Standardization Requirements

For alternative-fueled engines derived from a diesel-cycle engine, we are allowing the standardized requirements discussed in this section that are applicable to diesel engines rather than meeting the requirements applicable to gasoline engines.

G. Implementation Schedule, In-Use Liability, and In-Use Enforcement

1. Implementation Schedule and In-Use Liability Provisions

Table II.G–1 summarizes the implementation schedule for the OBD monitoring requirements, the certification requirements, and the in-use liabilities. This implementation schedule is identical to the proposed schedule. More detail regarding the implementation schedule and liabilities can be found in the sections that follow.

TABLE II.G–1—OBD CERTIFICATION REQUIREMENTS AND IN-USE LIABILITY FOR DIESEL FUELED AND GASOLINE FUELED ENGINES OVER 14,000 POUNDS

Model year	Applicability	Certification requirement	In-use liability
2010–2012	Parent rating within 1 compliant engine family.[a]	Full liability to thresholds according to certification demonstration procedures.[b]	Full liability to 2x thresholds.[c]
	Child ratings within the compliant engine family.	Certification documentation only (i.e., no certification demonstration); no liability to thresholds.	Liability to monitor and detect as noted in certification documentation.
	All other engine families and ratings	None	None.
2013–2015	Parent rating from 2010–2012 and parent rating within 1–2 additional engine families.	Full liability to thresholds according to certification demonstration procedures.	Full liability to 2x thresholds.
	Child ratings from 2010–2012 and parent ratings from any remaining engine families or OBD groups.[d]	Full liability to thresholds but certification documentation only.	Full liability to 2x thresholds.
	Additional engine ratings	Certification documentation only; no liability to thresholds.	Liability to monitor and detect as noted in certification documentation.
2016–2018	One rating from 1–3 engine families and/or OBD groups.	Full liability to thresholds according to certification demonstration procedures.	Full liability to thresholds.
	Remaining ratings	Full liability to thresholds but certification documentation only.	Full liability to 2x thresholds.
2019+	One rating from 1–3 engine families and/or OBD groups.	Full liability to thresholds according to certification demonstration procedures.	Full liability to thresholds.
	Remaining ratings	Full liability to thresholds but certification documentation only.	Full liability to thresholds.

Notes: (a) Parent and child ratings are defined in section II.G; which rating(s) serves as the parent rating and which engine families must comply is not left to the manufacturer, as discussed in section II.G. (b) The certification demonstration procedures and the certification documentation requirements are discussed in section VII. (c) Where in-use liability to thresholds and 2x thresholds is noted, manufacturer liability to monitor and detect as noted in their certification documentation is implied. (d) OBD groups are groupings of engine families that use similar OBD strategies and/or similar emissions control systems, as described in the text.

As we proposed, for the 2010 through 2012 model years, manufacturers are required to implement OBD on one engine family. All other 2010 through 2012 engine families are not subject to any OBD requirements unless otherwise required to do so (e.g., to demonstrate that SCR equipped vehicles will not be operated without urea). For 2013, manufacturers are required to implement OBD on all engine families.

We are setting this implementation schedule for several reasons. First, industry has made credible arguments that their resources are stretched to the limit developing and testing strategies for compliance with the 2007/2010 heavy-duty highway emissions standards. We do not want to jeopardize their success toward that goal by being too aggressive with our OBD program.

[63] See proposed § 86.010–18(k)(6)(i)(B) and compare to final § 86.010–18(k)(6)(i)(B).

[64] See proposed § 86.010–18(k)(4)(vi) and (k)(4)(vii)(A) and compare to final § 86.010–18(k)(4)(vi) and (k)(4)(vii)(A).

[65] See final §§ 86.010–18(k)(5) and 86.010–18(k)(6).

Second, OBD is a complex and difficult regulation with which to comply. We believe that our implementation schedule would give industry the opportunity to introduce OBD systems on a limited number of engines giving them and us very valuable learning experience. Should mistakes or errors in regulatory interpretation occur, the ramifications would be limited to only a subset of the new vehicle fleet rather than the entire new vehicle fleet. Lastly, the OBD requirements and the production vehicle evaluation provisions (discussed in Section VII), reflect 10 to 20 years of learning by EPA, CARB, and industry (primarily the light-duty gasoline industry) as to what works and what does not work. This is, perhaps, especially true for those OBD elements that involve the interface between the OBD system and service and I/M inspection personnel. Gasoline manufacturers have had the ability to evolve their OBD systems along with this learning process. However, diesel engine manufacturers have not really been involved in this learning process and, as a result, 100 percent implementation in 2010 would be analogous to implementing 10 to 20 years of OBD learning in one implementation step. We believe that implementing slowly rather than one big step will benefit everyone involved.

Table II.G–1 makes reference to ''parent'' and ''child'' ratings. In general, engine manufacturers certify an engine family that consists of several ratings having slightly different horsepower and/or torque characteristics but no differences large enough to require a different engine family designation. For emissions certification, the parent rating—i.e., the rating for which emissions data are submitted to EPA for the purpose of demonstrating emissions compliance—is defined as the ''worst case'' rating. This worst case rating is the rating considered as having the worst emissions performance and, therefore, its compliance demonstrates that all other ratings within the family must comply. For OBD purposes, we want to limit the burden on industry—hence the requirement for only one compliant engine family in 2010—yet maximize the impact of the OBD system. Therefore, for model years 2010 through 2012, we are defining the OBD parent rating as the rating having the highest weighted projected sales within the engine family having the highest weighted projected sales, with sales being weighted by the useful life of the engine rating. We have added a new provision that allows the Administrator to approve an alternative rating as the parent rating than that described by this text and this represents a slight departure from the proposal.[66] Table II.G–2 presents a hypothetical example for how this would work absent Administrator approval to do otherwise. Using this approach, the OBD compliant engine family in 2010 would be the engine family projected to produce the most in-use emissions (based on sales weighted by expected miles driven). Likewise, the fully liable parent OBD rating would be the rating within that family projected to produce the most in-use emissions.

TABLE II.G–2—HYPOTHETICAL EXAMPLE OF HOW THE OBD PARENT AND CHILD RATINGS WOULD BE DETERMINED

OBD group	Engine family	Rating	Projected sales	Certified useful life	OBD weighting—engine rating [a] (billions)	OBD weighting—engine family [b] (billions)
I	A	1	10,000	285,000	2.85	14.25
		2	40,000	285,000	11.4	
	B	1	10,000	435,000	4.35	21.60
		2	20,000	435,000	8.70	
		3	30,000	285,000	8.55	
II	C	1	20,000	110,000	2.20	7.70
		2	50,000	110,000	5.50	

Notes: (a) For engine family A, rating 1, 10,000 × 285,000/1 billion = 2.85. (b) For engine family A, 2.85 + 11.4 = 14.25.

In the example shown in Table II.G–2, the compliant engine family in 2010 would be engine family B and the parent OBD rating within that family would be rating 2. The other OBD compliant ratings within engine family B would be dubbed the ''child'' ratings. For model years 2013 through 2015, the parent ratings would be those ratings having the highest weighted projected sales within each of the one to three engine families having the highest weighted projected sales, with sales being weighted by the useful life of the engine rating. In the example shown in Table II.G–2, the parent ratings would be rating 2 of engine family A, rating 2 of engine family B, and rating 2 of engine family C (Note that this is only for illustration purposes since the regulations would not require that a manufacturer with only three engine families have three parent ratings and instead would require only one).

The manufacturer does not need to submit test data demonstrating compliance with the emissions thresholds for the child ratings. We would fully expect these child ratings to use OBD calibrations—i.e., malfunction trigger points—that are identical or nearly so to those used on the parent rating. However, we would allow manufacturers to revise the calibrations on their child ratings where necessary so as to avoid unnecessary or inappropriate MIL illumination. Such revisions to OBD calibrations have been termed ''extrapolated'' OBD calibrations and/or systems. The revisions to the calibrations on child ratings and the rationale for them will need to be very clearly described in the certification documentation.

For the 2013 and later model years, we are requiring that manufacturers certify one to three parent ratings. The actual number of parent ratings would depend upon the manufacturer's fleet and would be based on both the emissions control system architectures present in their fleet and the similarities/differences of the engine families in their fleet. For example, a manufacturer that uses a DPF with NO_X adsorber on each of the engines would have only one system architecture. Another manufacturer that uses a DPF with NO_X adsorber on some engines and a DPF with SCR on others would have

[66] See § 86.010–18(o)(1)(i) and (o)(2)(ii)(B) to see this new provision.

at least two architectures. We expect that manufacturers will group similar architectures and similar engine families into so called ''OBD groups.'' These OBD groups would consist of a combination of engines, engine families, or engine ratings that use the same OBD strategies and similar calibrations. The manufacturer will be required to submit details regarding their OBD groups as part of their certification documentation that shows the engine families and engine ratings within each OBD group for the coming model year. While a manufacturer may end up with more than three OBD groups, we do not intend to require a parent rating for more than three OBD groups. Therefore, in the example shown in Table II.G–2, rather than submitting test data for the three parent ratings as suggested above, the OBD grouping would result in the parent ratings being rating 2 of engine family B and rating 2 of engine family C. These parents would represent OBD groups I and II, and the manufacturer's product line. For 2013 through 2015, we will allow the 2010 parent to again act as a parent rating and, provided no significant changes had been made to the engine or its emissions control system, complete carryover would be possible. However, for model years 2016 and beyond, we would work closely with CARB staff and the manufacturer to determine the parent ratings so that the same ratings are not acting as the parents every year. In other words, our definitions for the OBD parent ratings as discussed here apply only during the years 2010 through 2012 and again for the years 2013 through 2015.

Also consistent with our proposal are the relaxations for in-use liability during the 2010 through 2018 model years. The first such relaxation is higher interim in-use compliance standards for those OBD monitors calibrated to specific emissions thresholds. For the 2010 through 2015 model years, an OBD monitor on an in-use engine will not be considered non-compliant (i.e., subject to enforcement action) unless emissions exceed twice the OBD threshold without detection of a malfunction. For example, for an EGR monitor on an engine with a NO_X FEL of 0.2 g/bhp–hr and an OBD threshold of 0.5 g/bhp–hr (i.e., the NO_X FEL+0.3), a manufacturer would not be subject to enforcement action unless emissions exceed 1.0 g/bhp–hr NO_X without a malfunction being detected. For the model years 2016 through 2018, parent ratings will be liable to the certification emissions thresholds, but child ratings and other ratings would be liable to twice the certification thresholds. Beginning in the 2019 model year, all families and all ratings would be liable to the certification thresholds.

The second in-use relaxation is a limitation in the number of engines that will be liable for in-use compliance with the OBD emissions thresholds. Consistent with our proposal, for 2010 through 2012, we are requiring that manufacturers be fully liable in-use to twice the thresholds for only the OBD parent rating. The child ratings within the compliant engine family would have liability for monitoring in the manner described in the certification documentation, but would not have liability for detecting a malfunction at the specified emissions thresholds. For example, a child rating's DPF monitor designed to operate under conditions X, Y, and Z and calibrated to detect a backpressure within the range A to B would be expected to do exactly that during in-use operation. However, if the tailpipe emissions of the child engine were to exceed the applicable OBD in-use thresholds (i.e., 2x the certification thresholds during 2010–2015), despite having a backpressure within range A to B under conditions X, Y, and Z, there would be no in-use OBD failure nor cause for enforcement action. In fact, we would expect the OBD monitor to determine that the DPF was functioning properly since its backpressure was in the acceptable range. For model years 2013 through 2015, this same in-use relaxation will apply to those engine families that do not lie within an engine family for which a parent rating has been certified. For 2016 and later model years, all engines will have some in-use liability to thresholds, either the certification thresholds or twice those thresholds.

These in-use relaxations are meant to provide ample time for manufacturers to gain experience without an excessive level of risk for mistakes. They also allow manufacturers to fine-tune their calibration techniques over a six to ten year period.

We are also requiring a specific implementation schedule for the standardization requirements discussed in section II.F. We initially intended to require that any compliant OBD engine family would be required to implement all of the standardization requirements. However, we became concerned that, during model years 2010 through 2012, we could have a situation where OBD compliant engines from manufacturer A might be competing against non-OBD engines from manufacturer B for sales in the same truck. In such a case, the truck builder would be placed in a difficult position of needing to design their truck to accommodate OBD compliant engines—along with a standardized MIL, a specific diagnostic connector location specification, etc.—and non-OBD engines. After consideration of this almost certain outcome, we decided to limit the standardization requirements that must be met during the 2010 through 2012 model years. Beginning in 2013, all engines will be OBD compliant and this would become a moot issue. Table II.G–3 shows the implementation schedule for standardization requirements.

TABLE II.G–3—OBD STANDARDIZATION REQUIREMENTS FOR DIESEL FUELED AND GASOLINE FUELED ENGINES OVER 14,000 POUNDS

Model year	Applicability	Required standardization features	Waived standardization features
2010–2012	Parent and Child ratings within 1 compliant engine family[a].	Emissions related functions (II.F.4) except for the requirement to make the data available in a standardized format or in accordance with SAE J1979/1939 specifications. MIL activation and deactivation.[b] Performance tracking—calculation of numerators, denominators, ratios.	Standardized connector (II.F.2). Dedicated (i.e., regulated OBD-only) MIL. Communication protocols (II.F.3). Emissions related functions (II.F.4) with respect to the requirement to make the data available in a standardized format or in accordance with SAE J1979/1939 specifications.
	Other engine families	None	All.
2013+	All engine families and ratings	All	None.

Notes: [a] Parent and child ratings are defined in section II.G; which rating serves as the parent rating and which engine families must comply is not left to the manufacturer, as discussed in section II.G. [b] There would be no requirement for a dedicated MIL and no requirement to use a specific MIL symbol, only that a MIL be used and that it use the specified activation/deactivation logic.

2. In-Use Enforcement

When conducting our in-use enforcement investigations into OBD systems, we intend to use all tools we have available to analyze the effectiveness and compliance of the system. These tools may include on-vehicle emission testing systems such as the portable emissions measurement systems (PEMS). We may also use scan tools and data loggers to analyze the data stream information to compare real world operation to the documentation provided at certification.

Importantly, we do not intend to pursue enforcement action against a manufacturer for not detecting a failure mode that could not have been reasonably predicted or otherwise detected using monitoring methods known at the time of certification. For example, we are imposing a challenging set of requirements for monitoring of DPF systems. As of today, engine manufacturers are reasonably confident in their ability to detect certain DPF failure modes at or near the final thresholds—e.g., a leaking DPF resulting from a cracked substrate—but are not confident in their ability to detect some other DPF failure modes—e.g., a leaking DPF resulting from a partially melted substrate. If a partially melted substrate indeed cannot be detected and this is known during the certification process, we cannot expect such a failure to be detected on an in-use vehicle.[67] This provision is consistent with our proposal.

We also want to make it clear who would be the responsible party should we pursue any in-use enforcement action with respect to OBD. We are very familiar with the heavy-duty industry and its tendency toward separate engine and component suppliers. This contrasts with the light-duty industry which tends toward a more vertically integrated structure. The non-vertically integrated nature of the heavy-duty industry can present unique difficulties for OBD implementation and for OBD enforcement. With the complexity of OBD systems, especially those meeting today's requirements, we expect the interactions between the various parties involved—engine manufacturer, transmission manufacturer, vehicle manufacturer, etc.—to be further complicated. Nonetheless, in the end the vast majority of the OBD requirements apply directly to the engine and its associated emission controls, and the engine manufacturer will have complete responsibility to ensure that the OBD system performs properly in-use. Given the central role the engine and engine control unit plays in the OBD system, we are requiring that the party certifying the engine and OBD system (typically, the engine manufacturer) be the responsible party for in-use compliance and enforcement actions. In this role, the certifying party will be our sole point of contact for potential noncompliances identified during in-use or enforcement testing. We will leave it to the engine manufacturer to determine the ultimate party responsible for the potential noncompliance (e.g., the engine manufacturer, the vehicle manufacturer, or some other supplier). In cases where remedial action such as an engine recall would be required, the certifying party would take on the responsibility of arranging to bring the engines or OBD systems back into compliance. Given that heavy-duty engines are already subject to various emission requirements including engine emission standards, labels, and certification, engine manufacturers currently impose restrictions via signed agreements with engine purchasers to ensure that their engines do not deviate from their certified configuration when installed. We expect the OBD system's installation to be part of such agreements in the future.

H. Changes to the Existing 8,500 to 14,000 Pound Diesel OBD Requirements

We are also making final certain changes to our OBD requirements for diesel engines used in heavy-duty vehicles under 14,000 pounds (see 40 CFR 86.007–17 for engine-based requirements and 40 CFR 86.1806–05 for vehicle or chassis-based requirements). Table II.H–1 summarizes the changes to under 14,000 pound heavy-duty diesel vehicle emissions thresholds at which point a component or system has failed to the point of requiring an illuminated MIL and a stored DTC. Table II.H–2 summarizes the changes for diesel engines used in heavy-duty applications under 14,000 pounds. The changes are meant to maintain consistency with the diesel OBD requirements for over 14,000 pound applications.

TABLE II.H–1—NEW AND/OR CHANGES TO EXISTING, EMISSIONS THRESHOLDS FOR DIESEL FUELED CI HEAVY-DUTY VEHICLES UNDER 14,000 POUNDS (G/MI)

Component/monitor	MY	NMHC	CO	NO_X	PM
NMHC catalyst system	2010–2012	2.5x			
	2013+	2x			
NO_X catalyst system	2007–2009			4x	
	2010–2012			+0.6	
	2013+			+0.3	
DPF system	2010–2012				4x
	2013+				+0.04
Air-fuel ratio sensors upstream	2007–2009	2.5x	2.5x	3x	4x
	2010–2012	2.5x	2.5x	+0.3	+0.02
	2013+	2x	2x	+0.3	+0.02
Air-fuel ratio sensors downstream	2007–2009	2.5x		3x	4x
	2010–2012	2.5x		+0.3	4x
	2013+	2x		+0.3	+0.04
NO_X sensors	2007–2009			4x	5x
	2010–2012			+0.6	4x
	2013+			+0.3	+0.04
"Other monitors" with emissions thresholds	2007–2009	2.5x	2.5x	3x	4x
	2010–2012	2.5x	2.5x	+0.3	4x
	2013+	2x	2x	+0.3	+0.02

Notes: MY=Model Year; 2.5x means a multiple of 2.5 times the applicable emissions standard; +0.3 means the standard plus 0.3; not all monitors have emissions thresholds but instead rely on functionality and rationality checks as described in section II.D.4.

[67] See, for example, § 86.010–18(p)(1)(iv).

TABLE II.H–2—NEW AND/OR CHANGES TO EXISTING, EMISSIONS THRESHOLDS FOR DIESEL FUELED CI ENGINES USED IN HEAVY-DUTY VEHICLES UNDER 14,000 POUNDS (G/BHP-HR)

Component/monitor	MY	Std/FEL	NMHC	CO	NO_X	PM
NMHC catalyst system	2010–2012	All	2.5x			
	2013+	All	2x			
NO_X catalyst system	2007–2009	>0.5 NO_X			1.75x	
	2007–2009	<=0.5 NO_X			+0.6	
	2010–2012	All			+0.6	
	2013+	All			+0.3	
DPF system	2010–2012	All				0.05/+0.04
	2013+	All				0.05/+0.04
Air-fuel ratio sensors upstream	2007–2009	>0.5 NO_X	2.5x	2.5x	1.75x	0.05/+0.04
	2007–2009	<=0.5 NO_X	2.5x	2.5x	+0.5	0.05/+0.04
	2010–2012	All	2.5x	2.5x	+0.3	0.03/+0.02
	2013+	All	2x	2x	+0.3	0.03/+0.02
Air-fuel ratio sensors downstream	2007–2009	>0.5 NO_X	2.5x		1.75x	0.05/+0.04
	2007–2009	<=0.5 NO_X	2.5x		+0.5	0.05/+0.04
	2010–2012	All	2.5x		+0.3	0.05/+0.04
	2013+	All	2x		+0.3	0.05/+0.04
NO_X sensors	2007–2009	>0.5 NO_X			1.75x	0.05/+0.04
	2007–2009	<=0.5 NO_X			+0.6	0.05/+0.04
	2010–2012	All			+0.6	0.05/+0.04
	2013+	All			+0.3	0.05/+0.04
"Other monitors" with emissions thresholds	2007–2009	>0.5 NO_X	2.5x	2.5x	1.75x	0.05/+0.04
	2007–2009	<=0.5 NO_X	2.5x	2.5x	+0.5	0.05/+0.04
	2010–2012	All	2.5x	2.5x	+0.3	0.03/+0.02
	2013+	All	2x	2x	+0.3	0.03/+0.02

Notes: MY=Model Year; 2.5x means a multiple of 2.5 times the applicable emissions standard or family emissions limit (FEL); +0.3 means the standard or FEL plus 0.3; 0.05/+0.04 means an absolute level of 0.05 or an additive level of the standard or FEL plus 0.04, whichever level is higher; not all monitors have emissions thresholds but instead rely on functionality and rationality checks as described in section II.D.4.

1. NO_X Aftertreatment Monitoring

We are requiring that the 8,500 to 14,000 pound NO_X aftertreatment monitoring requirements mirror those for engines used in vehicles over 14,000 pounds. The current regulations require detection of a NO_X catalyst malfunction before emissions exceed 1.5x the emissions standards. We do not believe that such a tight threshold level is appropriate for diesel SCR and lean NO_X catalyst systems. The final thresholds are less stringent than proposed until the 2013 model year where they are consistent with our proposal. We have made the thresholds less stringent for the same reasons as discussed in section II.B. The required monitoring conditions with respect to performance tracking (discussed in section II.B.6.c) would not apply for under 14,000 pound heavy-duty applications since we do not have performance tracking requirements for under 14,000 pound applications. We are proposing this change for the 2007 model year.

2. Diesel Particulate Filter System Monitoring

We are requiring that the 8,500 to 14,000 pound DPF monitoring requirements mirror those discussed in section II.B.8. Our current regulations require detection of a catastrophic failure only. The proposed monitoring requirements contained emissions thresholds like those proposed for over 14,000 pound OBD. The final PM thresholds remain unchanged from the proposal. We have eliminated the proposed NMHC thresholds for the same reasons we have eliminated the requirement to monitor NMHC conversion of the DPF in the over 14,000 pound applications. The required monitoring conditions with respect to performance tracking (discussed in section II.B.8.c) would not apply for under 14,000 pound heavy-duty applications since we do not have performance tracking requirements for under 14,000 pound applications. We are requiring no new DPF monitoring requirements in the 2007 to 2009 model years because there is not sufficient lead time for manufacturers to develop a new monitor. The new, more stringent monitoring requirements would begin in the 2010 model year. Also, for 2010 through 2012, we are providing the option to monitor and detect a decrease in the expected pressure drop across the DPF, consistent with the provisions for over 14,000 pound applications. This option is being made available only to the engine certified systems since the requirement is based on the engine certification procedure.

3. NMHC Converting Catalyst Monitoring

The final requirements for NMHC converting catalyst monitoring are identical to those we proposed. However, we have added the option to monitor the ability of the NMHC catalyst to generate a 100 degree C temperature rise, or to reach the necessary regeneration temperature, within 60 seconds of initiating a regeneration event. We have added other criteria for this optional monitoring approach to ensure that the necessary regeneration temperature is being sustained and that the regeneration attempt be aborted should the regeneration temperature not be reached or sustained properly. This makes the 8,500 to 14,000 pound provisions consistent with the over 14,000 pound provisions.

4. Other Monitors

The final requirements for "other monitors" are identical to those we proposed, except that we have revised the NO_X sensor monitor NO_X threshold to +0.6 to be consistent with changes made for other monitors discussed above.

5. CARB OBDII Compliance Option and Deficiencies

We are also making final the proposed changes to our deficiency provisions for vehicles and engines meant for vehicles under 14,000 pounds. We have included specific mention of air-fuel ratio sensors and NO_X sensors where we had long referred only to oxygen sensors. We have also updated the referenced CARB OBDII document that can be used to satisfy the federal OBD requirements.[68]

III. How Have the Service Information Availability Requirements Changed for This Final Rule?

A. What is the Important Background Information for the Provision Being Finalized for Service Information Availability?

Section 202(m)(5) of the CAA directs EPA to promulgate regulations requiring OEMs to provide to:

> Any person engaged in the repairing or servicing of motor vehicles or motor vehicle engines, and the Administrator for use by any such persons, * * * any and all information needed to make use of the [vehicle's] emission control diagnostic system * * * and such other information including instructions for making emission-related diagnoses and repairs.

Such regulations are subject to the requirements of section 208(c) regarding protection of trade secrets; however, no such information may be withheld under section 208(c) if that information is provided (directly or indirectly) by the manufacturer to its franchised dealers or other persons engaged in the repair, diagnosing or servicing of motor vehicles.

On June 27, 2003 EPA published a final rulemaking (68 FR 38428) which set forth the Agency's service information regulations for light- and heavy-duty vehicles and engines below 14,000 pounds GVWR. These regulations, in part, required each covered Original Equipment Manufacturer (OEM) to do the following: (1) OEMs must make full text emissions-related service information available via the World Wide Web. (2) OEMs must provide equipment and tool companies with information that allows them to develop pass-through recalibration tools. (3) OEMs must make available enhanced diagnostic information to equipment and tool manufacturers and to make available OEM-specific diagnostic tools for sale. These requirements were finalized to ensure that aftermarket service and repair facilities have access to the same emission-related service information, in the same or similar manner, as that provided by OEMs to their franchised dealerships.

In the NPRM, we proposed several provisions related to the availability of service information. We proposed to require that each heavy-duty Original Equipment Manufacturer (OEM) do the following: (1) Make full text emissions-related service information available via the World Wide Web; (2) provide equipment and tool companies with information that allows them to develop pass-through reprogramming tools; (3) make available enhanced diagnostic information to equipment and tool manufacturers and to make available OEM-specific diagnostic tools for sale; (4) make available emissions-related training information. EPA has carefully considered the comments we have received on our proposed requirements. The service information provisions finalized in today's action provide maximum flexibility to engine manufacturers while still meeting the intent of the Clean Air Act to ensure fair and reasonable access by aftermarket service providers to service information and tools needed to service and repairs emissions-related problems on heavy-duty engines.

B. What Provisions are Being Finalized for Service Information Availability?

1. What Information is the OEM Required to Make Available?

Today's action requires OEMs to make available to any person engaged in the repairing or servicing of heavy-duty motor vehicles or motor vehicle engines above 14,000 pounds all information necessary to make use of the OBD systems and any information for making emission-related repairs, including any emissions-related information that is provided by the OEM to franchised dealers, beginning generally with MY2010, though for the provisions related to scan tool availability, we are allowing manufacturers until MY2013 to comply. This information includes, but is not limited to, the following:

(1) Manuals, technical service bulletins (TSBs), diagrams, and charts (the provisions for training materials, including videos and other media are discussed in Sections III.A.3 and III.A.4 below).

(2) A general description of the operation of each monitor, including a description of the parameter that is being monitored.

(3) A listing of all typical OBD diagnostic trouble codes associated with each monitor.

(4) A description of the typical enabling conditions for each monitor to execute during vehicle operation, including, but not limited to, minimum and maximum intake air and engine coolant temperature, vehicle speed range, and time after engine startup. A listing and description of all existing monitor-specific drive cycle information for those vehicles that perform misfire, fuel system, and comprehensive component monitoring.

(5) A listing of each monitor sequence, execution frequency and typical duration.

(6) A listing of typical malfunction thresholds for each monitor.

(7) For OBD parameters that deviate from the typical parameters, the OBD description shall indicate the deviation for the vehicles it applies to and provide a separate listing of the typical values for those vehicles.

(8) Identification and scaling information necessary to interpret and understand data available to a generic scan tool through Diagnostic Message 8 pursuant to SAE Recommended Practice J1939–73 (revised September 2006).

(9) Any information related to the service, repair, installation or replacement of parts or systems developed by third party (Tier 1) suppliers for OEMs, to the extent they are made available to franchise dealerships.

(10) Any information on other systems that can directly effect the emission system within a multiplexed system (including how information is sent between emission-related system modules and other modules on a multiplexed bus),

(11) Any information regarding any system, component, or part of a vehicle monitored by the OBD system that could in a failure mode cause the OBD system to illuminate the malfunction indicator light (MIL).

(12) Any other information relevant to the diagnosis and completion of an emissions-related repair. This information includes, but is not limited to, information needed to start the vehicle when the vehicle is equipped with an anti-theft or similar system that disables the engine described below in paragraph (13). This information also includes any OEM-specific emissions-related diagnostic trouble codes (DTCs) and any related service bulletins, trouble shooting guides, and/or repair procedures associated with these OEM-specific DTCs.

(13) Information regarding how to obtain the information needed to perform reinitialization of any computer or anti-theft system following an emissions-related repair. OEMs are not required to make this information available on the OEM's Web site unless they choose to do so. However, the OEM's Web site shall contain information on alternate means for obtaining the information and/or ability to perform reintialization. Beginning with the 2013 model year, we require that all OEM systems will be designed in such a way that no special tools or

[68] See 13 CCR 1968.2, approved November 9, 2007, Docket ID# EPA–HQ–OAR–2005–0047–0045.

processes will be necessary to perform reinitialization.

2. What are the Requirements for Web-based Delivery of the Required Information?

a. OEM Web Sites

Today's action finalizes a provision that requires OEMs to make available in full-text all of the information outlined above, on individual OEM Web sites. The only exceptions to the full-text requirements are training information, anti-theft information, and indirect information. Provisions for the availability of training information are discussed in Section III.B.4 of this document. Today's action requires that each OEM launch their individual Web sites with the required information by July 1, 2010 for all 2010 and later model year vehicles.

b. Timeliness and Maintenance of Information on OEM Web Sites

Today's action finalizes a provision that requires OEMs to make available the required information on their Web site within six months of model introduction. After this six month period, the required information for each model must be available and updated on the OEM Web site at the same time it is available by any means to their dealers.

EPA is also finalizing a provision that, beginning with the 2010 model year, OEMs maintain the required information in full text for at least 15 years after model introduction. After this fifteen-year period, OEMs can archive the required service information, but it must be made available upon request, in a format of the OEM's choice (e.g., CD–ROM).

c. Accessibility, Reporting and Performance Requirements for OEM Web Sites

Performance reports that adequately demonstrate that their individual Web sites meets the requirements outlined in § 86.010–38(j)(18) will be submitted to the Administrator annually or upon request by the Administrator. These reports shall also indicate the performance and effectiveness of the Web sites by using commonly used Internet statistics (e.g., successful requests, frequency of use, number of subscriptions purchased, etc.) EPA will issue additional direction in the form of official manufacturer guidance to further specify the process for submitting reports to the Administrator. In addition, EPA is finalizing a provision that requires OEMs to launch Web sites that meet the following performance criteria:

(1) OEM Web sites shall possess, sufficient server capacity to allow ready access by all users and have sufficient downloading capacity to assure that all users may obtain needed information without undue delay;

(2) Any reported broken Web links shall be corrected or deleted weekly.

(3) Web site navigation does not require a user to return to the OEM home page or a search engine in order to access a different portion of the site.

(4) Any manufacturer-specific acronym or abbreviation shall be defined in a glossary webpage which, at a minimum, is hyperlinked by each webpage that uses such acronyms and abbreviations. OEMs may request Administrator approval to use alternate methods to define such acronyms and abbreviations. The Administrator shall approve such methods if the motor vehicle manufacturer adequately demonstrates that the method provides equivalent or better ease-of-use to the website user.

(5) Indicates the minimum hardware and software specifications required for satisfactory access to the Web site(s).

d. Structure and Cost of OEM Web Sites

OEMs must implement Web sites that offer a range of time periods for on-line access and/or the amount of information purchased.

For any time ranges approved by the Administrator, OEMs must make their entire site accessible for the respective period of time and price. In other words, an OEM may not limit any or all ranges to just one make or one model.

Prior to the official launch of OEM Web sites, each OEM will also be required to present to the Administrator a specific outline of what will be charged for access to each of the tiers. OEMs must justify these charges, and submit to the Administrator information on the following parameters, which include but are not limited to, the following:

(1) The price the manufacturer currently charges their branded dealers for service information. At a minimum, this must include the direct price charged that is identified exclusively as being for service information, not including any payment that is incorporated in other fees paid by a dealer, such as franchise fees. In addition, we are requiring that the OEM must describe the information that is provided to dealers, including the nature of the information (e.g., the complete service manual), etc.; whether dealers have the option of purchasing less than all of the available information, or if purchase of all information is mandatory; the number of branded dealers who currently pay for this service information; and whether this information is made available to any persons at a reduced or no cost, and if so, identification of these persons and the reason they receive the information at a reduced cost.

(2) The price the manufacturer currently charges persons other than branded dealers for service information. The OEM must describe the information that is provided, including the nature of the information (e.g., the complete service manual, emissions control service manual), etc.; and the number of persons other than branded dealers to whom the information is supplied.

(3) The estimated number of persons to whom the manufacturer would be expected to provide the service information following implementation of today's requirements.

A complete list of the criteria for establishing reasonable cost can be found in the regulatory language for this final rule.[69] We are also finalizing a provision that, subsequent to the launch of the OEM Web sites, OEMs would be required to notify the Administrator upon the increase in price of any one or all of their approved time ranges of twenty percent or more accounting for inflation or that sets the charge for end-user access over the established price guidelines discussed above, including a justification based on the criteria for reasonable cost as established by this regulation.

e. Hyperlinking to and From OEM Web Sites

Today's action finalizes a provision that requires OEMs to allow direct simple hyperlinking to their Web sites from government Web sites and from all automotive-related Web sites, such as aftermarket service providers, educational institutions, and automotive associations.

f. Administrator Access to OEM Web Sites

Today's action finalizes a provision that requires that the Administrator shall have access to each OEM Web site at no charge to the Agency. The Administrator shall have access to the site, reports, records and other information as provided by sections 114 and 208 of the Clean Air Act and other provisions of law.

g. Other Media

We are finalizing a provision that require OEMs to make available for ordering the required information in some format approved by the

[69] See § 86.010–38(j)(8).

Administrator directly from their Web site after the full-text window of 15 years has expired. OEMs shall index their available information with a title that adequately describes the contents of the document to which it refers. In the alternate, OEMs may allow for the ordering of information directly from their Web site, or from a Web site hyperlinked to the OEM Web site. OEMs are required to list a phone number and address where aftermarket service providers can call or write to obtain the desired information. OEMs must also provide the price of each item listed, as well as the price of items ordered on a subscription basis. To the extent that any additional information is added or changed for these model years, OEMs shall update the index as appropriate. OEMs will be responsible for ensuring that their information distributors do so within three business day of receiving the order.

h. Small Volume Provisions for OEM Web Sites

Manufacturers with total annual sales of less than 5,000 engines shall have until July 1, 2011 to launch their individual Web sites as discussed in Section III.B.2. Manufacturers with total annual sales of less than 1,000 engines may, in lieu of meeting the requirement for web-based delivery of service information, request the Administrator to approve an alternative method by which the required emissions-related information can be obtained.

These small-volume flexibilities are limited to the distribution and availability of service information via the World Wide Web under § 86.010–38 (j)(4) of the regulations. All OEMs, regardless of volume, must comply with all other provisions as finalized in this rulemaking.

3. What are the Requirements for Service Information for Third Party Information Providers?

Today's action finalizes a provision that will require OEMs who currently have, or in the future engage in, licensing or business arrangements with third party information providers, as defined in the regulations, to provide information to those parties in an electronic format in English that utilizes non-proprietary software. Any OEM licensing or business arrangements with third party information providers are subject to fair and reasonable cost requirements. We expect that OEMs will develop pricing structures for access to this information that make it affordable to any third party information providers with which they do business. This provision takes effect January 1, 2011 and will apply for model year 2010 and later engines.

4. What are the Requirements for the Availability of Training Information?

Today's action finalizes two provisions for access to OEM training on OEM Web sites. First, OEMs will be required to make available for purchase on their Web sites the following items: Training manuals, training videos, and interactive, multimedia CD's or similar training tools available to franchised dealerships. Second, we are finalizing a provision requiring OEMs who transmit emissions-related training via satellite or the Internet to tape these transmissions and make them available for purchase on their Web sites within 30 days after the first transmission to franchised dealerships. Manufacturers shall not be required to duplicate transmitted emissions-related training courses if anyone engaged in the repairing or servicing of heavy-duty engines has the opportunity to receive the Internet or satellite transmission, even if there is a cost associated with the equipment required to receive the transmission. Further, all of the items included in this provision must be shipped within 3 business days of the order being placed and are to be made available at a reasonable price. These requirements apply for 2010 and later model year vehicles beginning July 1, 2010. For subsequent model years, the required information must be made available for purchase within three months of model introduction, and then be made available at the same time it is made available to franchised dealerships.

5. What are the Requirements for Recalibration of Vehicles?

Today's action finalizes two options for pass-thru recalibration. We are finalizing a provision that heavy-duty OEMs must comply with SAE J2534–1 (Revised December 2004) beginning with the 2013 model year. In the alternative, heavy-duty OEMs may comply with the Technology and Maintenance Council's Recommended Practice RP1210B, ''Windows™ Communication API,'' (Revised June 2007) beginning in the 2013 model year. We are also finalizing a provision that will require that recalibration information be made available within 3 months of vehicle introduction for new models.

6. What are the Requirements for the Availability of Enhanced Information for Scan Tools for Equipment and Tool Companies?

a. Description of Information That Must Be Provided

Today's action finalizes a provision that requires OEMs to make available to equipment and tool companies all generic and enhanced information, including bi-directional control and data stream information. In addition, OEMs must make available the following information.

(i) The physical hardware requirements for data communication (e.g., system voltage requirements, cable terminals/pins, connections such as RS232 or USB, wires, etc.).

(ii) ECU data communication (e.g., serial data protocols, transmission speed or baud rate, bit timing requirements, etc.).

(iii) Information on the application physical interface (API) or layers (i.e., processing algorithms or software design descriptions for procedures such as connection, initialization, and termination).

(iv) Vehicle application information or any other related service information such as special pins and voltages or additional vehicle connectors that require enablement and specifications for the enablement.

(v) Information that describes which interfaces, or combinations of interfaces, from each of the categories as described in § 86.010–38(j)(14)(ii)(A) through (D) of the regulatory language.

Manufacturers are not required to make available to equipment and tool companies any information related to reconfiguration capabilities or any other information that would make permanent changes to existing engine configurations.

The requirements to release the information to equipment and tool companies takes effect on July 1, 2013 [for model year 2013 engines], and within 3 months of model introduction for all new model years.

b. Distribution of Enhanced Diagnostic Information

Today's action finalizes a provision that will require the above information for generic and enhanced diagnostic information be provided to aftermarket tool and equipment companies with whom appropriate licensing, contractual, and confidentiality agreements have been arranged. This information shall be made available in electronic format using common document formats such as Microsoft Excel, Adobe Acrobat, Microsoft Word, etc. Further, any OEM licensing or business arrangements with equipment and tool companies are subject to a fair and reasonable cost determination.

7. What are the Requirements for the Availability of OEM-Specific Diagnostic Scan Tools and Other Special Tools?

a. Availability of OEM-Specific Diagnostic Scan Tools

Today's action finalizes a provision that OEMs must make available for sale to interested parties the same OEM-specific scan tools that are available to franchised dealerships, except as discussed below. These tools shall be made available at a fair and reasonable price. These tools shall also be made available in a timely fashion either through the OEM Web site or through an OEM-designated intermediary.

Upon Administrator approval, manufacturers will not be required to make available manufacturer-specific tools with reconfiguration capabilities if they can demonstrate to the satisfaction of the Administrator that these tools are not essential to the completion of an emissions-related repair, such as recalibration. In addition, as a condition of purchase, manufacturers may request that the purchaser take all necessary training offered by the engine manufacturer, provided that those training requirements are outlined in § 86.010–38(j)(15) of the regulations.

8. Which Reference Materials are Being Incorporated by Reference?

We are requiring that service information requirements comply with the provisions laid out in certain Society of Automotive Engineers (SAE) and/or Truck Maintenance Council (TMC) documents that are incorporated by reference (IBR) into federal regulation. Details regarding these SAE and TMC documents can be found in § 86.1(b) and in § 86.010–38(j).

IV. What Are the Emissions Reductions Associated With the OBD Requirements?

In the 2007HD highway rule, we estimated the emissions reductions we expected to occur as a result of the emissions standards being made final in the rule. Since the OBD requirements contained in today's rule are considered by EPA to be an important element of the 2007HD highway program and its ultimate success, rather than a new element being included as an addition to that program, we are not estimating emissions reductions associated with OBD. Instead, we consider the new 2007/2010 tailpipe emissions standards and fuel standards to be the drivers of emissions reductions and HDOBD to be part of the assurance we all have that those emissions reductions are indeed realized. Therefore, this analysis presents the emissions reductions estimated for the 2007HD highway program. Inherent in those estimates is an understanding that, while emissions control systems sometimes malfunction, they presumably are repaired in a timely manner. Today's OBD requirements would provide substantial tools to assure that our presumption will be realized by helping to ensure that emission control systems continue to operate properly throughout their life. We believe that the OBD requirements will lead to more repairs of malfunctioning or deteriorating emission control systems, and may also lead to emission control systems that are more robust throughout the life of the engine and less likely to trigger illumination of MILs. The requirements would therefore provide greater assurance that the emission reductions expected from the Clean Diesel Trucks and Buses program will actually occur. Viewed from another perspective, while the OBD requirements will not increase the emission reductions that we estimated for the 2007HD highway rule, they would be expected to lead to actual emission reductions in-use compared with a program with no OBD system.

The costs associated with HDOBD were not fully estimated in the 2007HD highway rule. Those costs are more fully considered in section V of this preamble. These newly developed HDOBD costs are added to those costs estimated for the 2007/2010 standards and a new set of costs for those standards are presented in section VI. Section VI also calculates a new set of costs per ton associated with the 2007/2010 standards which include the previously estimated costs and emissions reductions for the 2007/2010 standards and the newly estimated costs associated with today's HDOBD rule.

Here we present the emission benefits we anticipate from heavy-duty vehicles as a result of our 2007/2010 NO_X, PM, and NMHC emission standards for heavy-duty engines. The graphs and tables that follow illustrate the Agency's projection of future emissions from heavy-duty vehicles for each pollutant. The baseline case represents future emissions from heavy-duty vehicles at present standards (including the MY2004 standards). The controlled case represents the future emissions from heavy-duty vehicles once the new 2007/2010 standards are implemented. A detailed analysis of the emissions reductions associated with the 2007/2010 HD highway standards is contained in the Regulatory Impact Analysis for that final rule.[70] The results of that analysis are presented in Table IV.A–1 and in Figures IV.A–1 through IV.A–3.

TABLE IV.A–1—ANNUAL EMISSIONS REDUCTIONS ASSOCIATED WITH THE 2007HD HIGHWAY PROGRAM

[Thousand short tons]

Year	NO_X	PM	NMHC
2007	58	11	2
2010	419	36	21
2015	1,260	61	54
2020	1,820	82	83
2030	2,570	109	115

[70] Regulatory Impact Analysis: Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements; EPA420–R–00–026; December 2000.

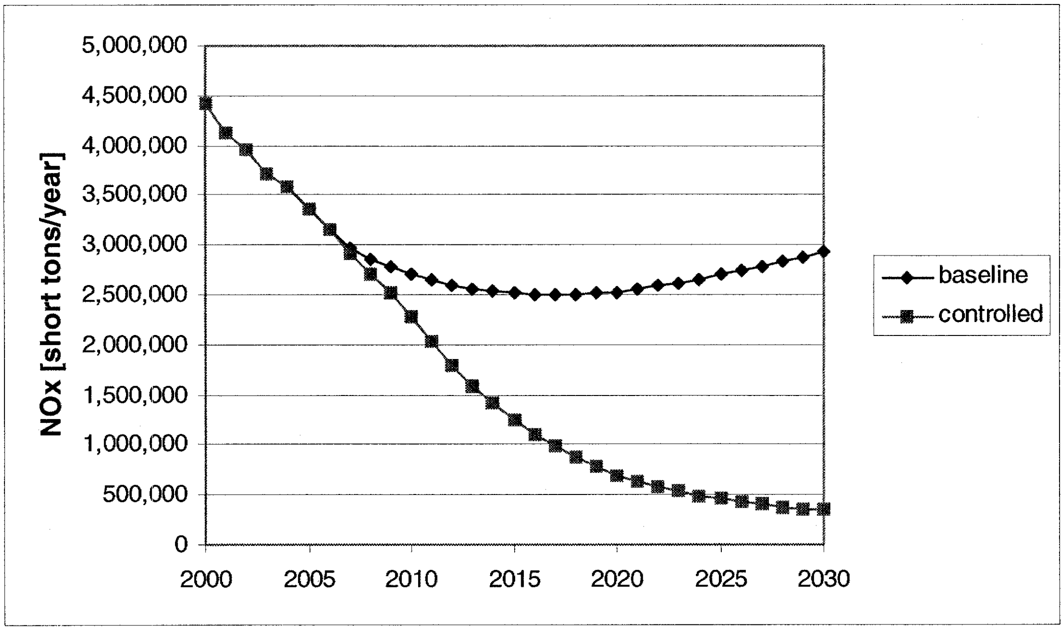


Figure IV.A-1: Projected Nationwide Heavy-Duty Vehicle NOx Emissions; Control Case Represents the 2007/2010 Emissions Standards

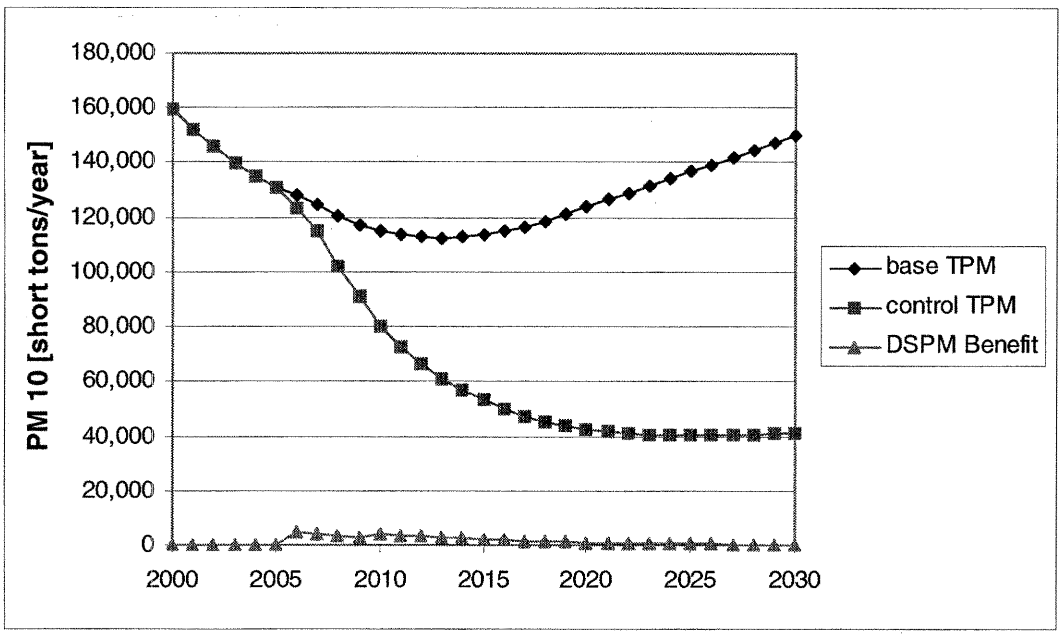


Figure IV.A-2: Projected Nationwide Heavy-Duty Vehicle PM Emissions and Direct Sulfate PM Emission Reductions; Control Case Represents the 2007/2010 Emissions Standards

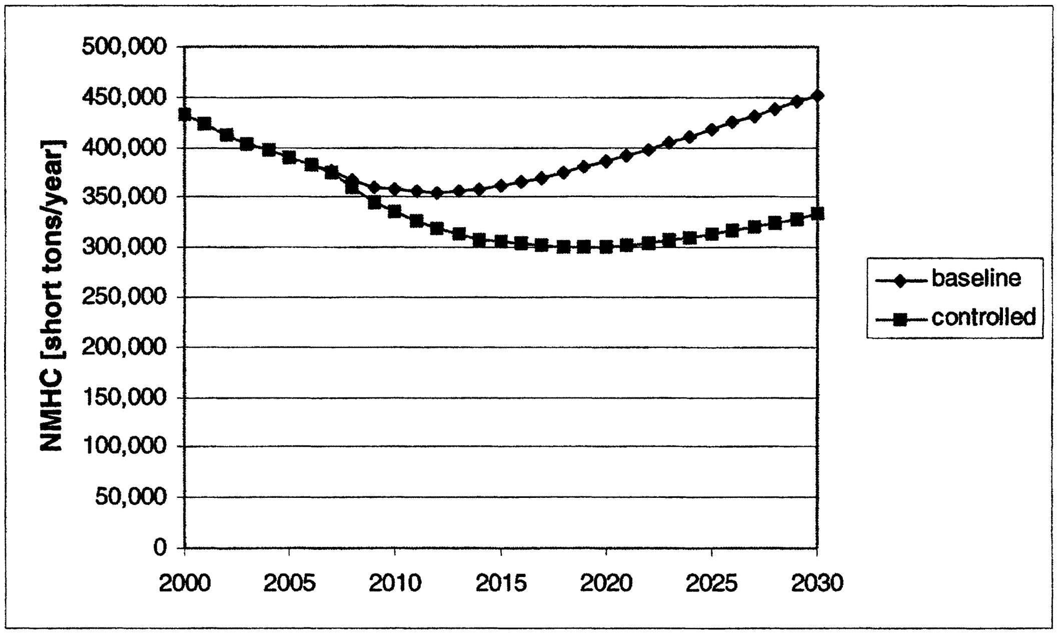


Figure IV.A-3: Projected Nationwide Heavy-Duty Vehicle NMHC Emissions; Control Case Represents the 2007/2010 Emissions Standards

There were additional estimated emissions reductions associated with the 2007HD highway rule—namely CO, SO_x, and air toxics. We have not presented those additional emissions reductions here since, while HDOBD will identify malfunctions and hasten their repair with the result of reducing all emissions constituents, these additional emissions are not those specifically targeted by OBD systems.

V. What Are the Costs Associated With the OBD Requirements?

The costs estimated for the final OBD requirements are identical to those estimated for the proposed OBD requirements with three notable exceptions. First, we have included costs for aging limit parts to their OBD thresholds. We inadvertently did not include those costs in the draft analysis. Discussion of this can be found in the Summary and Analysis of Comments document in Section VI.B. These newly added costs are also presented in detail in Section 3.1.2.b of the final technical support document.[71] Both of these documents can be found in the docket for this rule. Second, while in the proposal we estimated lower warranty costs beginning in 2013, we have delayed that until 2016 in the final rule. This is discussed in Section VI.A of the Summary and Analysis of Comments document and in Section 3.1.1 of the final technical support document. Third, we have adjusted all costs to 2007 dollars—the draft analysis used 2004 dollars—by using the Consumer Price Index. As a result, all costs presented here are slightly higher than in the draft analysis although we have not changed the analysis with the exception of this adjustment for inflation and, as mentioned previously, the addition of costs for aging of limit parts and delay of lower warranty costs.

Here we present the updated tables that appeared in our preamble to the proposed regulations.[72] Please refer to the final technical support document contained in the docket for the details of the analysis behind these cost estimates.

A. Variable Costs for Engines Used in Vehicles Over 14,000 Pounds

The variable costs we have estimated represent those costs associated with various sensors that we believe will be added to the engine to provide the required OBD monitoring capability. For the 2010 model year, we believe that upgraded computers and the new sensors needed for OBD would result in costs to the buyer of $43 and $53 for diesel and gasoline engines, respectively. For the 2013 model year, we have included costs associated with the dedicated MIL and its wiring resulting in a hardware cost to the buyer of $60 and $70 for both diesel and gasoline engines, respectively. In 2016, these costs become $57 and $66 for diesel and gasoline, respectively, due to a reduction in warranty costs. By multiplying these costs per engine by the projected annual sales we get annual costs of around $45–55 million for diesel engines and $3–4 million for gasoline engines, depending on sales. The 30-year net present value of the annual variable costs would be $737 million and $391 million at a three percent and a seven percent discount rate, respectively. These costs are summarized in Table V.A–1.

[71] Final Technical Support Document, HDOBD final rule, EPA420–R–08–019, Docket ID# EPA–HQ–OAR–2005–0047–0056.

[72] See 72 FR 3273, Section VI.

TABLE V.A–1—OBD VARIABLE COSTS FOR ENGINES USED IN VEHICLES OVER 14,000 POUNDS

[All costs in $millions except per engine costs; 2007 dollars]

	Diesel	Gasoline	Total
Cost per engine (2010–2012)	$43	$53	n/a
Cost per engine (2013–2015)	60	70	n/a
Cost per engine (2016+)	57	66	n/a
Annual Variable Costs in 2010 [a]	15	1	$16
Annual Variable Costs in 2013 [a]	44	3	47
Annual Variable Costs in 2016 [a]	43	3	47
Annual Variable Costs in 2030 [a]	53	4	57
30 year NPV at a 3% discount rate	686	51	737
30 year NPV at a 7% discount rate	364	27	391

[a] Annual variable costs increase as projected sales increase.

B. Fixed Costs for Engines Used in Vehicles Over 14,000 Pounds

We have estimated fixed costs for research and development (R&D), certification, and production evaluation testing. The R&D costs include the costs to develop the computer algorithms required to diagnose engine and emission control systems, and the costs for applying the developed algorithms to each engine family and to each variant within each engine family. R&D costs also include the testing time and effort needed to develop and apply the OBD algorithms. The certification costs include the costs associated with testing of durability engines (i.e., the OBD parent engines), the costs associated with generating the ''limit'' parts that are required to demonstrate OBD detection at or near the applicable emissions thresholds, and the costs associated with generating the necessary certification documentation. Production evaluation testing costs included the costs associated with the three types of production testing: Standardization features, monitor function, and performance ratios.

Table V.B–1 summarizes the R&D, certification, and production evaluation testing costs that we have estimated. The R&D costs we have estimated were totaled and then spread over the four year period prior to implementation of the requirements for which the R&D is conducted. By 2013, all of the R&D work would be completed in advance of 100 percent compliance in 2013; hence, R&D costs are zero by 2013. Certification costs are higher in 2013 than in 2010 because 2010 requires one engine family to comply while 2013 requires all engine families to comply. The 30 year net present value of the annual fixed costs would be $475 million and $352 million at a three percent and a seven percent discount rate, respectively.

TABLE VI.B–1—OBD FIXED COSTS FOR ENGINES USED IN VEHICLES OVER 14,000 POUNDS

[All costs in $millions; 2007 dollars]

	Diesel			Gasoline			Total
	R&D	Certification & PE testing	Subtotal	R&D	Certification & PE testing	Subtotal	
Annual OBD Fixed Costs in given years							
2010	$56	$0.2	$56	$1.0	<$0.1	$1.0	$57
2013	0	0.4	0.4	0	<0.1	<0.1	0.4
2030	0	35	35	0	<0.1	<0.1	35
30 year NPV at the given discount rate							
3%	287	176	463	11.1	0.4	11.4	475
7%	243	99.6	342	9.7	0.2	9.9	352

C. Total Costs for Engines Used in Vehicles Over 14,000 Pounds

The total OBD costs for engines used in vehicles over 14,000 pounds are summarized in Table V.C–1. As shown in the table, the 30 year net present value cost is estimated at $1.2 billion and $743 million at a three percent and a seven percent discount rate, respectively. These costs are much lower than the 30 year net present value costs estimated for gasoline and diesel engines meeting the 2007HD highway emissions standards which were $30 billion and $18 billion at a three percent and a seven percent discount rate, respectively (in 2007 dollars). Including the cost for the diesel fuel changes resulted in 30 year net present value costs for that rule of $88 billion and $53 billion at a three percent and a seven percent discount rate, respectively (in 2007 dollars). See section VI for more details regarding the cost estimates from the 2007HD highway final rule.

TABLE V.C–1—OBD TOTAL COSTS FOR ENGINES USED IN VEHICLES OVER 14,000 POUNDS

[All costs in $millions; 2007 dollars]

	Diesel	Gasoline	Total
Annual OBD Total Costs in given years			
2010	$71	$2	$67
2013	44	3	47
2030	89	4	93
30 year NPV at the given discount rate			
3%	1,150	63	1,212
7%	706	37	743

D. Costs for Diesel Heavy-Duty Vehicles and Engines Used in Heavy-Duty Vehicles Under 14,000 Pounds

The total OBD costs for 8,500 to 14,000 pound diesel applications are summarized in Table V.D–1. As shown in the table, the 30 year net present value cost is estimated at $16 million and $12 million at a three percent and a seven percent discount rate, respectively. These costs represent the incremental costs of the additional OBD requirements, as compared to our current OBD requirements, for 8,500 to 14,000 pound diesel applications and do not represent the total costs for 8,500 to 14,000 pound diesel OBD. We are making no changes to the 8,500 to 14,000 pound gasoline requirements so, therefore, have estimated no costs for gasoline vehicles. Details behind these estimated costs can be found in the final technical support document contained in the docket for this rule.[73]

TABLE V.D–1—TOTAL OBD COSTS FOR 8,500 TO 14,000 POUND DIESEL APPLICATIONS

[All costs in $millions; 2007 dollars]

	Diesel	Gasoline	Total
Annual OBD Total Costs in given years			
2010	$0.1	$0	$0.1
2013	0	0	0
2030	2	0	2
30 year NPV at the given discount rate			
3%	16	0	16
7%	12	0	12

VI. What are the Updated Annual Costs and Costs per Ton Associated With the 2007/2010 Heavy-Duty Highway Program?

In the 2007HD highway rule, we estimated the costs we expected to occur as a result of the emissions standards being made final in that rule. As noted in section IV, we consider the OBD requirements contained in today's rule to be an important element of the 2007HD highway program and its ultimate success and not a new element being included as an addition to that program. In fact, without the OBD requirements we would not expect the emissions reductions associated with the 2007/2010 standards to be fully realized because emissions control systems cannot be expected to operate without some need for repair which, absent OBD, may well never be done. However, as noted in section V, because we did not include an OBD program in the 2007HD highway program, we did not estimate OBD related costs at that time. We have now done so and those costs are presented in section V.

Here we present the OBD costs as part of the greater 2007HD highway program. To do this, we present both the costs developed for that program and the additional OBD costs presented in section V. We also calculate a new set of costs per ton associated with the 2007/2010 standards which include the previously estimated costs and emissions reductions for the 2007/2010 standards and the newly estimated costs associated with today's HDOBD rule.

Note that the costs estimates associated with the 2007HD highway program were done using 1999 dollars. We have adjusted those costs to 2007 dollars using the Consumer Price Index.[74]

A. Updated 2007 Heavy-Duty Highway Rule Costs Including OBD

Table VI.A–1 shows the 2007HD highway program costs along with the estimated OBD related costs.

[73] Final Technical Support Document, HDOBD final rule, EPA420–R–08–019, Docket ID# EPA–HQ–OAR–2005–0047–0056.

[74] *http://www.bls.gov/cpi*; U.S. city average, all items, not seasonally adjusted.

TABLE VI.A–1—UPDATED 2007HD HIGHWAY PROGRAM COSTS INCLUDING NEW OBD-RELATED COSTS NET PRESENT VALUE OF ANNUAL COSTS FOR THE YEARS 2006–2035

[All costs in $millions; 2007 dollars]

Discount rate	2007 HD highway final rule				Final HD OBD	Updated total program costs
	Diesel engine costs	Gasoline engine & vehicle costs	Diesel fuel costs	Original total costs		
3%	$29,500	$1,880	$56,240	$87,600	$1,230	$88,900
7%	17,900	1,090	33,560	52,500	755	53,300

B. Updated 2007 Heavy-Duty Highway Rule Costs per Ton Including OBD

Table VI.B–1 shows the 2007HD highway program costs per ton of pollutant reduced. These numbers are from the 2007HD highway final rule—updated to 2007 dollars—which contains the details regarding the split between NO_X+NMHC and PM related costs.

TABLE VI.B–1—ORIGINAL 2007HD HIGHWAY PROGRAM COSTS, EMISSIONS REDUCTIONS, AND $/TON REDUCED NET PRESENT VALUES ARE FOR ANNUAL COSTS FOR THE YEARS 2006–2035

[Monetary values in 2007 dollars]

Discount rate	Pollutant	30 year NPV cost ($billions)	30 year NPV reduction (million tons)	$/ton
3%	NO_X+NMHC	68.0	30.6	$2,220
	PM	19.9	1.4	14,750
7%	NO_X+NMHC	43.4	16.2	2,680
	PM	12.8	0.8	17,090

Table VI.B–2 shows the updated 2007HD highway program costs per ton of pollutant reduced once the new OBD costs have been included. For the split between NO_X+NMHC and PM related OBD costs, we have used a 50/50 allocation. As shown in Table VI.B–2, the OBD costs associated with the final OBD requirements have little impact on the overall costs and costs per ton of emissions reduced within the context of the 2007HD highway program.

TABLE VI.B–2—UPDATED 2007HD HIGHWAY PROGRAM COSTS, EMISSIONS REDUCTIONS, AND $/TON REDUCED INCLUDING OBD RELATED COSTS NET PRESENT VALUES ARE FOR ANNUAL COSTS FOR THE YEARS 2006–2035

[Monetary values in 2007 dollars]

Discount rate	Pollutant	30 year NPV cost ($billions)	30 year NPV reduction (million tons)	$/ton
3%	NO_X+NMHC	68.6	30.6	$2,240
	PM	20.5	1.4	15,210
7%	NO_X+NMHC	43.8	16.2	2,700
	PM	13.2	0.8	17,600

VII. How Have the Proposed Requirements for Engine Manufacturers Changed for This Final Rule?

A. Documentation Requirements

The OBD system certification requirements require manufacturers to submit OBD system documentation that represents each engine family. The certification documentation must contain all of the information needed to determine if the OBD system meets the OBD requirements. The regulation lists the information that is required as part of the certification package. If any of the information in the certification package is the same for all of a manufacturer's engine families (e.g., the OBD system general description), the manufacturer is required to submit one set of documents each model year for such items that cover all of its engine families.

While the majority of the OBD requirements apply to the engine and are incorporated by design into the engine control module by the engine manufacturer, a portion of the OBD requirements would apply to the vehicle and not be self-contained within the engine. Examples include the requirements to have a MIL in the instrument cluster and a diagnostic connector in the cab compartment. As is currently done by the engine manufacturers, a build specification is provided to vehicle manufacturers detailing mechanical and electrical specifications that must be adhered to for proper installation and use of the engine (and to maintain compliance with emissions standards). We expect engine manufacturers will continue to follow this practice so that the vehicle manufacturer would be able to maintain compliance with the OBD regulations. Installation specifications would be expected to include instructions regarding the location, color, and display icon of the MIL (as well as electrical connections to ensure proper illumination), location and type of diagnostic connector, and electronic VIN access. During the certification process, in addition to submitting the details of all of the diagnostic strategies and other information required, engine manufacturers are required to submit a copy of the OBD-relevant installation specifications provided to vehicle manufacturers and a description of the method used by the engine manufacturer to ensure vehicle manufacturers adhere to the provided installation specifications (e.g., required audit procedures or signed agreements to adhere to the requirements). We are requiring that this information be submitted to us to provide a reasonable level of verification that the OBD requirements will indeed be satisfied. In summary, engine manufacturers are responsible for submitting a certification package that includes:

- A detailed description of all OBD monitors, including monitors on signals or messages coming from other modules upon which the engine control unit relies to perform other OBD monitors; and,
- A copy of the OBD-relevant installation specifications provided to vehicle manufacturers/chassis builders and the method used to reasonably ensure compliance with those specifications.

As was discussed in the context of our implementation schedule (see section II.G.1), the regulations would allow engine manufacturers to establish OBD groups consisting of more than one engine family with each having similar OBD systems. The manufacturer could then submit only one set of representative OBD information from each OBD group. We anticipate that the representative information would normally consist of an application from a single representative engine rating within each OBD group. In selecting the engine ratings to represent each OBD group, consideration should be given to the exhaust emission control components for all engine families and ratings within an OBD group. For example, if one engine family within an OBD group has additional emission control devices relative to another family in the group (e.g., the first family has a DPF+SCR while the second has only a DPF), the representative rating should probably come from the first engine family. Manufacturers seeking to consolidate several engine families into one OBD group would be required to get approval of the grouping prior to submitting the information for certification.

Two of the most important parts of the certification package would be the OBD system description and summary table. The OBD system description would include a complete written description for each monitoring strategy outlining every step in the decision-making process of the monitor, including a general explanation of the monitoring conditions and malfunction criteria. This description should include graphs, diagrams, and/or other data that would help our compliance staff understand how each monitor works and interacts. The OBD summary table would include specific parameter values. This table would provide a summary of the OBD system specifications, including: the component/system, the DTC identifying each related malfunction, the monitoring strategy, the parameter used to detect a malfunction and the malfunction criteria limits against which the parameter is evaluated, any secondary parameter values and the operating conditions needed to run the monitor, the time required to execute and complete a monitoring event for both a pass decision and a fail decision, and the criteria or procedure for illuminating the MIL. In these tables, manufacturers are required to use a common set of engineering units to simplify and expedite the review process.

We are also requiring that the manufacturer submit a logic flowchart for each monitor that would illustrate the step-by-step decision process for determining malfunctions. Additionally, we would need any data that supports the criteria used to determine malfunctions that cause emissions to exceed the specified malfunction thresholds (see Tables II.B–1 and II.C–1). The manufacturer would have to include data that demonstrates the probability of misfire detection by the misfire monitor over the full engine speed and load operating range (for gasoline engines only) or the capability of the misfire monitor to correctly identify a ''one cylinder out'' misfire for each cylinder (for diesel engines only), a description of all the parameters and conditions necessary to begin closed-loop fuel control operation (for gasoline engines only), closed-loop EGR control (for diesel engines only), closed-loop fuel pressure control (for diesel engines only), and closed-loop boost control (for diesel engines only). We also need a listing of all electronic powertrain input and output signals (including those not monitored by the OBD system) that identifies which signals are monitored by the OBD system, and the emission data from the OBD demonstration testing (as described below). Lastly, the manufacturer will be expected to provide any other OBD-related information necessary to determine the OBD compliance status of the manufacturer's product line.

The only change to the final documentation requirements relative to the proposed requirements is a new provision applicable to those OBD systems designed to the CARB HDOBD requirements. Any such system must have detailed documentation describing how the system meets the full intent behind the requirements of § 86.010–18.[75] It will not be sufficient for a manufacturer to submit OBD documentation and a statement that it is a California HDOBD system or even a California approved OBD system. The certification documentation must include details about how the system compares to the requirements of § 86.010–18 to ensure that we can be comfortable approving that system for certification.

B. Catalyst Aging Procedures

For purposes of determining the catalyst malfunction criteria for diesel NMHC converting catalysts, SCR catalysts, and lean NO_X catalysts, and for gasoline catalysts (i.e., for generating OBD threshold parts, or limit parts), where those catalysts are monitored individually, the manufacturer must use a catalyst deteriorated to the malfunction criteria using methods established by the manufacturer to represent real world catalyst deterioration under normal and malfunctioning engine operating conditions. For purposes of determining the catalyst malfunction criteria for diesel NMHC converting catalysts, SCR catalysts, and lean NO_X catalysts, and for gasoline catalysts, where those catalysts are monitored in combination with other catalysts, the manufacturer must submit their catalyst system aging and monitoring plan to the Administrator as part of their certification documentation package. The plan must include the description, emission control purpose, and location of each component, the monitoring strategy for each component and/or combination of components, and the method for determining the applicable malfunction criteria including the deterioration/aging process.

C. Demonstration Testing

While the certification documentation requirements discussed above require manufacturers to submit technical details of each monitor (e.g., how each

[75] See section 86.010–18(m)(3) which is new in the final regulations. Also see § 86.010–18(a)(5) which is new in the final regulations. Also see section II.A.5, above.

monitor worked, when the monitor would run), we still need some assurance that the manufacturer's OBD monitors are indeed calibrated correctly and are able to detect a malfunction before an emissions threshold is exceeded. Thus, we are requiring that manufacturers conduct certification demonstration testing of the major monitors to verify the malfunction threshold values. This testing will be required on one to three demonstration engines per year. Before receiving a certificate of compliance, the manufacturer must submit documentation and emissions data demonstrating that the major OBD monitors are able to detect a malfunction when emissions exceed the emissions thresholds. On each demonstration engine, this testing would consist of the following two elements:

• Testing the OBD system with ''threshold'' components (i.e., components that are deteriorated or malfunctioning right at the threshold required for MIL illumination); and,

• Testing the OBD system with ''worst case'' components. This element of the demonstration test must be done for the DPF and any NO_X aftertreatment system only.

By testing with both threshold components (i.e., the best performing malfunctioning components) and with worst case components (i.e., the worst performing malfunctioning components), we will be better able to verify that the OBD system should perform as expected regardless of the level of deterioration of the component. This could become increasingly important with new technology aftertreatment devices that could be subject to complete failure (such as DPFs) or even to tampering by vehicle operators looking to improve fuel economy or vehicle performance. We believe that, given the likely combinations of emissions control hardware, a diesel engine manufacturer would likely need to conduct 8 to 10 emissions tests per demonstration engine to satisfy these requirements and a gasoline engine manufacturer would likely need to conduct five to seven emissions tests per demonstration engine.[76]

1. Selection of Test Engines

To minimize the test burden on manufacturers, we are requiring that this testing be done on only one to three demonstration engines per year per manufacturer rather than requiring that all engines be tested. Such an approach should still allow us to be reasonably sure that manufacturers have calibrated their OBD systems correctly on all of their engines. This also spreads the test burden over several years and allows manufacturers to better utilize their test cell resources. This approach is consistent with our approach to demonstration testing to existing emissions standards where a parent engine is chosen to represent each engine family and emissions test data for only that parent engine are submitted to EPA.[77]

The number of demonstration engines manufacturers must test will be aligned with the phase-in of OBD in the 2010 and 2013 model years and based on the year and the total number of engine families the manufacturer will be certifying for that model year. Specifically, for the 2010 model year when a manufacturer is only required to implement OBD on a single engine family, demonstration testing will be required on only one engine (a single engine rating within the one engine family). This will be the OBD parent rating as discussed in section II.G. For the 2013 model year, manufacturers will be required to conduct demonstration testing on one to three engines per year (i.e., one to three OBD parent ratings). The number of parent ratings would be chosen depending on the total number of engine families certified by the manufacturer. A manufacturer certifying one to five engine families in the given year would be required to test one demonstration engine. A manufacturer certifying six to ten engine families in the given year would be required to test two demonstration engines, and a manufacturer certifying more than ten engine families in the given year will be required to test three demonstration engines. For the 2016 and subsequent model years, we intend to work closely with CARB staff and the manufacturer to determine the parent ratings so that the same ratings are not acting as the parents every year. In other words, our definitions for the OBD parent ratings as discussed here apply only during the years 2010 through 2012 and again for the years 2013 through 2015.

Given the difficulty and expense in removing an in-use engine from a vehicle for engine dynamometer testing, this demonstration testing will likely represent nearly all of the OBD emission testing that would ever be done on these engines. Requiring a manufacturer who is fully equipped to do such testing, and already has the engines on engine dynamometers for emission testing, to test one to three engines per year would be a minimal testing burden that provides invaluable and, in a practical sense, otherwise unobtainable proof of compliance with the OBD emissions thresholds.

Regarding the selection of which engine ratings will have to be demonstrated, manufacturers are required to submit descriptions of all engine families and ratings planned for the upcoming model year. We will review the information and make the selection(s) in consultation with CARB staff and the manufacturer. For each engine family and rating, the information submitted by the manufacturer will need to identify engine model(s), power ratings, applicable emissions standards or family emissions limits, emissions controls on the engine, and projected engine sales volume. Factors that would be used in selecting the one to three engine ratings for demonstration testing include, but are not limited to, new versus old/carryover engines, emissions control system design, possible transition point to more stringent emissions standards and/or OBD emissions thresholds, and projected sales volume.

2. Required Testing

Regarding the actual testing, the manufacturer will be required to perform ''single fault'' testing using the applicable test procedure and with the appropriate components/systems set at the manufacturer defined malfunction criteria limits for the following monitors:

• For diesel engines: Fuel system; misfire; EGR; turbo boost control; NMHC catalyst; SCR catalyst/NO_X catalyst/adsorber; DPF; exhaust gas sensors; VVT; and any other monitor that would fall within the discussion of section II.D.5.

• For gasoline engines: Fuel system; misfire; EGR; cold start strategy; secondary air; catalyst; exhaust gas sensors; VVT; and any other monitor that would fall within the discussion of section II.D.5.

Such ''single fault'' testing requires that, when performing a test for a

[76] For diesel engines these would include: The fuel system; misfire (HCCI engines); EGR, turbo boost control, DPF, NO_X adsorber or SCR system, NMHC catalyst, exhaust gas sensors, VVT, and possible other emissions controls (see section II.D.5). For gasoline engines these would include: The fuel system, misfire, EGR, cold start strategy, secondary air system, catalyst, exhaust gas sensors, VVT, and possible other emissions controls (see section II.D.5). Some of these may require more than one emissions test while others may not require any due to the use of a functional monitor rather than an emissions threshold monitor.

[77] For over 14,000 pound OBD, we have a different definition of a ''parent'' engine than is used for emissions certification. This is discussed at length in section II.G.

specific parameter, that parameter must be operating at the malfunction criteria limit while all other parameters would be operating within normal characteristics (unless the malfunction prohibits some other parameter from operating within its normal characteristics). Also, the manufacturer will be allowed to use computer modifications to cause the specific parameter to operate at the malfunction limit provided the manufacturer can demonstrate that the computer modifications produce test results equivalent to an induced hardware malfunction. Lastly, for each of these testing requirements, wherever the manufacturer has established that only a functional check is required because no failure or deterioration of the specific tested component/system can result in an engine's emissions exceeding the applicable emissions thresholds, the manufacturer will not be required to perform a demonstration test. In such cases, the manufacturer can simply provide the data and/or engineering analysis used to determine that only a functional test of the component/system is required.

Manufacturers that are required to submit data from more than one engine rating will be granted some flexibility by allowing the data to be collected under less rigorous testing requirements than the official FTP or SET certification test. That is, for the possible second and third engine ratings required for demonstration testing, manufacturers will be allowed to submit data using internal sign-off test procedures that are representative of the official FTP or SET in lieu of running the official test. Commonly used procedures include the use of engine emissions test cells with less rigorous quality control procedures than those required for the FTP or SET or the use of forced cool-downs to minimize time between tests. Manufacturers will still be liable for meeting the OBD emissions thresholds on FTPs and/or SETs conducted in full accordance with the Code of Federal Regulations. Nonetheless, this latitude will allow them to use some short-cut methods that they have developed to assure themselves that the system is calibrated to the correct level without incurring the additional testing cost and burden of running the official FTP or SET on every demonstration engine.

For the demonstration engine(s), a manufacturer will be required to use an engine(s) aged for a minimum of 125 hours plus exhaust aftertreatment devices aged in a manner representative of full useful life. We are allowing for rapid aging using a process approved by the Administrator. Manufacturers would be expected to use, subject to approval, an aging process that ensures that deterioration of the exhaust aftertreatment devices is stabilized sufficiently such that it properly represents the performance of the devices at the applicable point in their useful life. Note that, should the 2010 model year engine be carried over for 2013 model year certification (which we fully expect most manufacturers to do), we would not require any new demonstration aging or testing.

3. Testing Protocol

We have made no changes in the final rule relative to the proposal as regards testing protocol. We are allowing the manufacturer to use any applicable test cycle for preconditioning test engines prior to conducting each of the emissions tests discussed above. Additional preconditioning can be done if the manufacturer can provide data and/or engineering analyses that demonstrate that additional preconditioning is necessary.

The manufacturer will then set the system or component of interest at the criteria limit(s) prior to conducting the applicable preconditioning cycle(s). If more than one preconditioning cycle is being used, the manufacturer may adjust the system or component of interest prior to conducting the subsequent preconditioning cycle. However, the manufacturer may not replace, modify, or adjust the system or component of interest following the last preconditioning cycle.

After preconditioning, the test engine will be operated over the applicable test cycle to allow for the initial detection of the tested system or component malfunction. This test cycle may be omitted from the testing protocol if it is unnecessary. If required by the designated monitoring strategy, a cold soak may be performed prior to conducting this test cycle. The test engine will then be operated over the applicable exhaust emission test.

A manufacturer required to test more than one test engine may use internal calibration sign-off test procedures (e.g., forced cool downs, less frequently calibrated emission analyzers) instead of official test procedures to obtain this emissions test data for all but one of the required test engines. However, the manufacturer should use sound engineering judgment to ensure that the data generated using such alternative test/sign-off procedures are good data because manufacturers would still be responsible for meeting the malfunction criteria when emissions tests are performed in accordance with official test procedures.

Manufacturers will be allowed to use alternative testing protocols, even chassis testing, for demonstration of MIL illumination if the engine dynamometer emissions test cycle does not allow all of a monitor's enable conditions to be satisfied. A manufacturer wanting to do so will be required to demonstrate the technical necessity for using their alternative test cycle and that using it demonstrates that the MIL will illuminate during in-use operation with the malfunctioning component.

4. Evaluation Protocol

We have made no changes in the final rule relative to the proposal as regards evaluation protocol. For all demonstration tests on parent engines, we will expect the MIL to activate upon detecting the malfunctioning system or component, and that it will occur before the end of the first engine start portion of the emissions test. If the MIL activates prior to emissions exceeding the applicable malfunction criteria, no further demonstration will be required. With respect to the misfire monitor demonstration test, if the manufacturer has elected to use the minimum misfire malfunction criterion of one percent (as is allowed), then no further demonstration would be required provided the MIL illuminates during a test with an implanted misfire of one percent.

If the MIL does not activate when the system or component being tested is set at its malfunction criteria limits, then the criteria limits or the OBD system would not be considered acceptable. Retesting would be required with more tightly controlled criteria limits (i.e., recalibrated limits) and/or another suitable system or component that would result in MIL activation. If the criteria limits are recalibrated, the manufacturer would be required to confirm that the systems and components that were tested prior to recalibration would still function properly and as required.

5. Confirmatory Testing

We have made no changes in the final rule relative to the proposal as regards confirmatory testing. We may choose to confirmatory test a demonstration engine to verify the emissions test data submitted by the manufacturer. Any such confirmatory testing would be limited to the engine rating represented by the demonstration engine(s) (i.e., the parent engine(s)). To do so, we, or our designee, would install appropriately deteriorated or malfunctioning components (or simulate a deteriorated or malfunctioning component) in an otherwise properly functioning engine of the same engine family and rating as the demonstration engine. Such confirmatory testing would be done on those OBD monitors for which demonstration testing had been conducted as described in this section. The manufacturer would be required to make available, upon Administrator request, a test engine and all test equipment—e.g., malfunction simulators, deteriorated components—necessary to duplicate the manufacturer's testing. As with our emission certification program, any failure to pass confirmatory testing means that no certificate would be issued until the cause of the noncompliance is fixed.

D. Deficiencies

Our under 14,000 pound OBD requirements have contained a deficiency provision for years. The OBD deficiency provision was first introduced on March 23, 1995 (60 FR 15242), and was revised on December 22, 1998 (63 FR 70681). Consistent with that provision, we proposed and are finalizing a deficiency provision for over 14,000 pound OBD. We believe that, like has occurred and even still occurs with under 14,000 pound OBD, some manufacturers will encounter unforeseen and generally last minute problems with some of their OBD monitoring strategies despite having made a good faith effort to comply with the requirements. Therefore, we are providing a provision that would permit certification of an over 14,000 pound OBD system with ''deficiencies'' in cases where a good faith effort to fully comply has been demonstrated. In making deficiency determinations, we will consider the extent to which the OBD requirements have been satisfied overall based on our review of the certification application, the relative performance of the given OBD system compared to systems that truly are fully compliant with the OBD requirements, and a demonstrated good-faith effort on the part of the manufacturer to both meet the requirements in full and come into full compliance as expeditiously as possible.

We believe that having the deficiency provision is important because it facilitates OBD implementation by allowing for certification of an engine despite having a relatively minor shortfall. Note that we do not expect to certify engines with OBD systems that have more than one deficiency, or to allow carryover of any deficiency to the following model year unless it can be demonstrated that correction of the deficiency requires hardware and/or software modifications that cannot be accomplished in the time available, as determined by the Administrator.[78] Nonetheless, we recognize that there may be situations where more than one deficiency is necessary and appropriate, or where carry-over of a deficiency or deficiencies for more than one year is necessary and appropriate. In such situations, more than one deficiency, or carry-over for more than one year, may be approved, provided the manufacturer has demonstrated an acceptable level of effort toward full OBD compliance. Most importantly, the deficiency provisions cannot be used as a means to avoid compliance or delay implementation of any OBD monitors or as a means to compromise the overall effectiveness of the OBD program.

There has often been some confusion by manufacturers regarding what CARB has termed ''retroactive'' deficiencies. The CARB rule states that, ''During the first 6 months after commencement of normal production, manufacturers may request that the Executive Officer grant a deficiency and amend an engine's certification to conform to the granting of the deficiencies for each aspect of the monitoring system: (a) Identified by the manufacturer (during testing required by section (l)(2) or any other testing) to be functioning different than the certified system or otherwise not meeting the requirements of any aspect of section 1971.1; and (b) reported to the Executive Officer.'' [79] We have never had and did not propose any such retroactive deficiency provision. We have regulations in place that govern situations, whether they be detected by EPA or by the manufacturer, where in-use vehicles or engines are determined to be functioning differently than the certified system.[80] We refer to these regulations as our defect reporting requirements and manufacturers are required to comply with these regulations, even for situations deemed by CARB to be ''retroactive'' deficiencies, unless the defect is corrected prior to the sale of engines to an ultimate purchaser. In other words, a retroactive deficiency granted by the Executive Officer does not preclude a manufacturer from complying with our defect reporting requirements.

[78] The CARB HDOBD rulemaking has a provision to charge fees associated with OBD deficiencies 13 CCR 1971.1(k)(3), Docket ID# EPA–HQ–OAR–2005–0047–0006. We have never had and will continue not to have any such fee provision.

[79] See 13 CCR 1971.1(k)(6), Docket ID# EPA–HQ–OAR–2005–0047–0006.

[80] See 40 CFR 85.1903.

E. Production Evaluation Testing

We have made no changes in the final rule relative to the proposal as regards production evaluation testing. The OBD system is a complex software and hardware system, so there are many opportunities for unintended interactions that can result in certain elements of the system not working as intended. We have seen many such mistakes in the under 14,000 pound arena ranging from OBD systems that are unable to communicate any information to a scan tool to monitors that are unable to store a DTC and illuminate the MIL. While over 14,000 pound heavy-duty vehicles are very different from light-duty vehicles in terms of emission controls and OBD monitoring strategies, among other things, these types of problems do not depend on these differences and, as such, are as likely to occur with over 14,000 pound OBD as they are with under 14,000 pound OBD. Additionally, we believe that there is great value in having manufacturers self-test actual production end products that operate on the road, as opposed to pre-production products, where errors can be found in individual subsystems that may work fine by themselves but not when integrated into a complete product (e.g., due to mistakes like improper wiring).

Therefore, we are requiring that manufacturers self-test a small fraction of their product line to verify compliance with the OBD requirements. The test requirements are divided into three distinct sections with each section representing a test for a different portion of the OBD requirements. These three sections being: compliance with the applicable SAE and/or ISO standardization requirements; compliance with the monitoring requirements for proper DTC storage and MIL illumination; and, compliance with the in-use monitoring performance ratios.

1. Verification of Standardization Requirements

An essential part of the OBD system is the requirement for standardization. The standardization requirements include items as simple as the location and shape of the diagnostic connector (where technicians can ''plug in'' a scan tool to the onboard computer) to more complex subjects concerning the manner and format in which DTC information is accessed by technicians via a ''generic'' scan tool. Manufacturers must meet these standardization requirements to facilitate the success of the OBD program because they ensure consistent access by all repair technicians to the stored information in the onboard computer. The need for consistency is even greater when considering the potential use of OBD system checks in inspection and maintenance (I/M) programs for heavy-duty. Such OBD based I/M checks would benefit from having access to the diagnostic information in the onboard computer via a single ''generic'' scan tool instead of individual tools for every make and model of truck that might be inspected. For OBD based inspections to work effectively and efficiently, all engines/vehicles must be designed and built to meet all of the applicable standardization requirements.

While we anticipate that the vast majority of vehicles would comply with all of the standardization requirements, some problems involving the communication between vehicles and ''generic'' scan tools are likely to occur in the field. The cause of such problems could range from differing interpretations of the existing standardization requirements to possible oversights by design engineers or hardware inconsistencies or even last-minute production changes on the assembly line.

To minimize the chance for such problems on future over 14,000 pound trucks, we are requiring that engine manufacturers test a sample of production vehicles from the assembly line to verify that the vehicles have indeed been designed and built to the required specifications for communication with a ''generic'' scan tool. We are requiring that manufacturers test complete vehicles to ensure that they comply with some of the basic ''generic'' scan tool standardization requirements, including those that are essential for proper inspection in an I/M setting. Ideally, manufacturers would test one vehicle for each truck and engine model combination that is introduced into commerce. However, for a large engine manufacturer, this can be in the neighborhood of 5,000 to 10,000 unique combinations making it unreasonable to require testing of every combination. Therefore, we are requiring that manufacturers test 10 such combinations per engine family. Given that a typical engine family has roughly five different engine ratings, this works out to testing only around two vehicles per engine rating.

More specifically, manufacturers must test one vehicle per software ''version'' released by the manufacturer. With proper demonstration, manufacturers will be allowed to group different calibrations together to be demonstrated by a common vehicle. Prior to acquiring these data, the engine manufacturer must submit for approval a test plan verifying that the vehicles scheduled for testing will be representative of all vehicle configurations (e.g., each engine control module variant coupled with and without the other available vehicle components that could affect scan tool communication such as automatic transmission or hybrid powertrain control modules). The plan must include details on all the different applications and configurations that will be tested.

As noted, manufacturers will be required to conduct this testing on actual production vehicles, not stand-alone engines. This is important since controllers that work properly in a stand alone setting (e.g., the engine before it is installed in a vehicle) may have interaction problems when installed and attempting to communicate with other vehicle controllers (e.g., the transmission controller). In such a case, separate testing of the controllers would be blind to the problem. Since heavy-duty engine manufacturers are expected to sell the same engine (with the same calibration) to various vehicle manufacturers who would put them in different final products (e.g., with different transmission control modules), the same communication problem would be expected in each final product.

This testing should occur soon enough in the production cycle to provide manufacturers with early feedback regarding the existence of any problems and time to resolve the problem prior to the entire model year's products being introduced into the field. We are requiring that the testing be done and the data submitted to us within either three months of the start of normal engine production or one month of the start of vehicle production, whichever is later.

To be sure that all manufacturers are testing vehicles to the same level of stringency, we are requiring that engine manufacturers submit documentation outlining the testing equipment and methods they intend to use to perform this testing. We anticipate that engine manufacturers and scan tool manufacturers will probably develop a common piece of hardware and software that could be used by all engine manufacturers at the end of the vehicle assembly line to meet this requirement. Two different projects (SAE J1699 and LOC3T) have developed such equipment in response to California OBD II requirements.[81] The equipment is currently being used to test 2005 and 2006 model year vehicles under 14,000 pounds. We believe that similar equipment could be developed for vehicles over 14,000 pounds in time for the 2013 model year. Ideally, the equipment and the test procedure would verify each and every requirement of the communication specifications including the various physical layers, message structure, response times, and message content. Presumably, any such verification equipment would not replace the function of existing ''generic'' scan tools used by repair technicians or I/M inspectors. The equipment would likely be custom-designed and be used for the express purpose of this assembly line testing (i.e., it would not include all of the necessary diagnostic features needed by repair technicians).

2. Verification of Monitoring Requirements

As noted above, the OBD system is a complex software and hardware system, so there are many opportunities for unintended interactions that can result in certain elements of the system not working as intended. The causes of possible problems vary from simple typing errors in the software code to component supplier hardware changes late in development or just prior to start of production. Given the complexity of OBD monitors and their associated algorithms, there can be thousands of lines of software code required to meet the diagnostic requirements. Implementing that code without interfering with the software code required for normal operation is and will be a very difficult task with many opportunities for human error. We expect that manufacturers will conduct some validation testing on end products to ensure that there are no problems that would be noticed by the vehicle operator. We believe that manufacturers should include in such verification testing an evaluation of the OBD system (e.g., does the MIL illuminate as intended in response to a malfunction?).

Therefore, we are requiring that engine manufacturers perform a thorough level of validation testing on at least one production vehicle and up to two more production engines per model year. The production vehicles/engines required for testing would have to be equipped with/be from the same engine families and ratings as used for the certification demonstration testing described in section VII.C. If a manufacturer demonstrated one, two, or three engines for certification, then at least one production vehicle and perhaps an additional one to two

[81] 13 CCR 1968.2, August 11, 2006, Docket ID# EPA–HQ–OAR–2005–0047–0005.

engines would have to be tested, respectively. We will work with the manufacturer and CARB staff to determine the actual vehicles and engines to test.

The testing itself will consist of implanting or simulating malfunctions to verify that virtually every single engine-related OBD monitor on the vehicle correctly identifies the malfunction, stores an appropriate DTC, and illuminates the MIL. Manufacturers will not be required to conduct any emissions testing. Instead, for those malfunctions designed against an emissions threshold, the manufacturer would simply implant or simulate a malfunction and verify detection, DTC storage, and MIL illumination. Actual ''threshold'' parts will not be needed for such testing. Implanted malfunctions could use severely deteriorated parts if desired by the manufacturer since the point of the testing is to verify detection, DTC storage, and MIL illumination. Upon submitting the data to the Administrator, the manufacturer will be required to also provide a description of the testing and the methods used to implant or simulate each malfunction. Note that testing of specific monitors will not be required if the manufacturer can show that no possible test exists that could be done on that monitor without causing physical damage to the production vehicle. We are requiring that the testing be completed and reported to us within six months after the manufacturer begins normal engine production. This should provide early feedback on the performance of every monitor on the vehicle prior to too many entering production. Upon good cause, we may extend the time period for testing.

Note that, in their HDOBD rule,[82] CARB allows, as an incentive to perform a thorough validation test, a manufacturer to request that any problem discovered during this self-test be treated as a ''retroactive'' deficiency. As discussed in section VII.D, we do not have a provision for retroactive deficiencies. Importantly, a retroactive deficiency granted by the Executive Officer does not preclude a manufacturer from complying with our defect reporting requirements. This issue was discussed in more detail in section VII.D.

3. Verification of In-Use Monitoring Performance Ratios

We are requiring that manufacturers track the performance of several of the most important monitors on the engine to determine how often they are monitoring during in-use operation. These requirements are discussed in more detail in section II.E. To summarize that discussion, monitors are expected to execute in the real world and meet a minimum acceptable performance level determined as the ratio of the number of good monitoring events to the number of actual trips. The ratio required is 10 percent, meaning that monitors should execute during at least 10 percent of the trips taken by the engine/vehicle. Monitors that perform below the minimum ratio will be subject to remedial action and possibly recall. However, the minimum ratio is not effective until the 2013 and later model years. For the 2010 through 2012 model year engines certified to today's OBD requirements, we are requiring that the data be collected even though the minimum ratio is not yet effective. The data gathered on these engines will help to determine whether the 10 percent ratio is appropriate for all applications and, if not, we intend to propose a change to the requirement to reflect that learning.

We are requiring that the engine manufacturer gather these data on production vehicles rather than engines. Since not every vehicle can be evaluated, we are requiring that manufacturers generate groups of engine/vehicle combinations to ensure adequate representation of the fleet. Specifically, manufacturers will be required to separate production vehicles into monitoring performance groups based on the following criteria and submit performance ratio data representative of each group:

- Emission control system architecture type—All engines that use the same or similar emissions control system architecture and associated monitoring system would be in the same emission architecture category. By architecture we mean engines with EGR + DPF + SCR, or EGR + DPF + NO_X Adsorber, or EGR + DPF-only, etc.
- Application type—Within an emission architecture category, engines would be separated by vehicle application. The separate application categories would be based on three classifications: engines intended primarily for line-haul chassis applications, engines intended primarily for urban delivery chassis applications, and all other engines.

We are requiring that these data be submitted to us within 12 months of the production vehicles entering the market. Upon submitting the collected data to us, the manufacturer must also provide a detailed description of how the data were gathered, how vehicles were grouped to represent sales of their engines, and the number of engines tested per monitoring performance group. Manufacturers will be required to submit performance ratio data from a sample of at least 15 vehicles per monitoring performance group. For example, a manufacturer with two emission control system architectures sold into each of the line-haul, urban delivery, and ''other'' groupings, will be required to submit data on up to 90 vehicles (i.e., $2 \times 3 \times 15$). We are requiring that these data be collected every year. Some manufacturers may find it easiest to collect data from vehicles that come in to its authorized repair facilities for routine maintenance or warranty work during the time period required, while others may find it more advantageous to hire a contractor to collect the data. Upon good cause, we may extend the time period for testing.

As stated before, the data collected under this program are intended primarily to provide an early indication that the systems are working as intended in the field, to provide information to ''fine-tune'' the requirement to track the performance of monitors, and to provide data to be used to develop a more appropriate minimum ratio for future regulatory revisions. The data are not intended to substitute for testing that we would perform for enforcement reasons to determine if a manufacturer is complying with the minimum acceptable performance ratios. In fact, the data collected would not likely meet all the required elements for testing to make an official determination that the system is noncompliant. As such, we believe the testing will be of most value to manufacturers since monitor performance problems can be corrected prior to EPA conducting a full enforcement action that could result in a recall.

VIII. What Are the Issues Concerning Inspection and Maintenance Programs?

In the preamble to our proposal, we included a discussion of issues surrounding potential future HDOBD-based I/M programs. However, while we sought comment on these issues, we did not make any formal proposals regarding HDOBD-based I/M. We received a fair amount of comment and have summarized those comments in the Summary and Analysis document contained in the docket for this rule.[83] We are taking no final action regarding HDOBD-based I/M at this time. We refer

[82] 13 CCR 1971.1, Docket ID# EPA–HQ–OAR–2005–0047–0006.

[83] Summary and Analysis of Comments document, HDOBD final rule, EPA420–R–08–018, Docket ID# EPA–HQ–OAR–2005–0047–0055.

the reader to the proposal for our discussion of the issues, and our Summary and Analysis document for a summary of the comments we received.

IX. Statutory and Executive Order Reviews

A. Executive Order 12866: Regulatory Planning and Review

This action is not a ''significant regulatory action'' under the terms of Executive Order (EO) 12866 (58 FR 51735, October 4, 1993) and is, therefore, not subject to review under the EO.

EPA prepared an analysis of the potential costs associated with this action. This analysis is contained in the technical support document.[84] A copy of the analysis is available in the docket and was summarized in section V of this preamble.

B. Paperwork Reduction Act

The information collection requirements for this action 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.* The Information Collection Request (ICR) document prepared by EPA has been assigned EPA ICR number 1684.13. Under Title II of the Clean Air Act (42 U.S.C. 7521 *et seq.*; CAA), EPA is charged with issuing certificates of conformity for those engines that comply with applicable emission standards. Such a certificate must be issued before engines may be legally introduced into commerce. EPA uses certification information to verify that the proper engine prototypes have been selected and that the necessary testing has been performed to assure that each engine complies with emission standards. In addition, EPA also has the authority under Title II of the Clean Air to ensure compliance by require in-use testing of vehicles and engines. EPA is requiring additional information at the time of certification to ensure that the on-board diagnostic (OBD) requirements are being met. EPA is also requiring that manufacturers conduct and report the results of in-use testing of the OBD systems to demonstrate that they are performing properly. Therefore, EPA is requiring 207 hours of annual burden per each of the 12 respondents to conduct the OBD certification, compliance, and in-use testing requirements required by this action. EPA estimates that the total of the of the 2484 hours of annual cost burden will be $16,018 per respondent for a total annual industry cost burden for the 12 respondents of $1,236,481.

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; technology and systems for the purposes of collecting, validating, and verifying. This includes the time needed to review instructions; develop, acquire, install, and utilize 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 in 40 CFR are listed in 40 CFR part 9.

C. Regulatory Flexibility Act (RFA), as Amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), 5 U.S.C. 601 et seq.

The Regulatory Flexibility Act (RFA) generally requires an agency to prepare a regulatory flexibility analysis of any rule subject to notice and comment rulemaking requirements under the Administrative Procedure Act or any other statute unless the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities. Small entities include small businesses, small organizations, and small governmental jurisdictions.

For purposes of assessing the impacts of this action on small entities, small entity is defined as: (1) A small businesses defined by the Small Business Administration's (SBA) regulations at 13 DFR 121.201; (2) a small governmental jurisdiction that is a government of a city, county, town, school district or special district with a population of less than 50,000; and (3) a small organization that is any not-for-profit enterprise which is independently owned and operated and is not dominant in its field.

After considering the economic impacts of this action on small entities, I certify that this final action will not have a significant economic impact on a substantial number of small entities. This action will not impose any requirements on small entities. This action places new requirements on manufacturers of large engines meant for highway use. These are large manufacturers. This action also changes existing requirements on manufacturers of passenger car and smaller heavy-duty engines meant for highway use. These changes place no meaningful new requirements on those manufacturers.

D. 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 section 202 of the UMRA, EPA generally must prepare a written statement, including a cost-benefit analysis, for proposed and final rules with ''Federal mandates'' that may result in expenditures to state, local, and tribal governments, in the aggregate, or to the private sector, of $100 million or more for any single year. Before promulgating a 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 to 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 that is not the least costly, most cost-effective, or least burdensome alternative if the Administrator publishes with the final rule an explanation of why such an alternative was not adopted.

Before EPA establishes any regulatory requirement 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.

This rule contains no federal mandates (under the regulatory provisions of Title II of the UMRA) for State, local, or tribal governments or the private sector. The rule imposes no enforceable duties on any of these entities. Nothing in the rule would significantly or uniquely affect small governments. We have determined that this rule does not contain a federal

[84] Final Technical Support Document, HDOBD final rule, EPA420–R–08–019, Docket ID# EPA–HQ–OAR–2005–0047–0056.

mandate that may result in estimated expenditures of more than $100 million to the private sector in any single year. Therefore, this action is not subject to the requirements of sections 202 or 205 of the UMRA. Further, this action is also not subject to the requirements of section 203 of UMRA.

E. Executive Order 13132: Federalism

Executive Order 13132, entitled ''Federalism'' (64 FR 43255, August 10, 1999), requires EPA to develop an accountable process to ensure ''meaningful and timely input by State and local officials in the development of regulatory policies that have federalism implications.'' ''Policies that have federalism implications'' is defined in the Executive Order to include regulations that have ''substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government.''

This action does not have federalism implications. It will not have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government, as specified in Executive Order 13132. This action places new requirements on manufacturers of large engines meant for highway use and changes existing requirements on manufacturers of passenger car and smaller heavy-duty engines meant for highway use. These changes do not affect States or the relationship between the national government and the States. Thus, Executive Order 13132 does not apply to this rule.

F. Executive Order 13175: Consultation and Coordination With Indian Tribal Governments

Executive Order 13175, entitled ''Consultation and Coordination with Indian Tribal Governments'' (65 FR 67249, November 9, 2000), requires EPA to develop an accountable process to ensure ''meaningful and timely input by tribal officials in the development of regulatory policies that have tribal implications.'' This action does not have tribal implications, as specified in Executive Order 13175. This action does not uniquely affect the communities of American Indian tribal governments since the motor vehicle requirements for private businesses in this action would have national applicability. Furthermore, this action does not impose any direct compliance costs on these communities and no circumstances specific to such communities exist that would cause an impact on these communities beyond those discussed in the other sections of this document. Thus, Executive Order 13175 does not apply to this action.

G. Executive Order 13045: Protection of Children From Environmental Health and Safety Risks

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.

This action is not subject to the Executive Order because it is not an economically significant regulatory action as defined by Executive Order 12866, and because the Agency does not have reason to believe the environmental health or safety risks addressed by this action present a disproportionate risk to children.

H. Executive Order 13211: Actions That Significantly Affect Energy Supply, Distribution, or Use

This action is not subject to Executive Order 13211 (66 FR 28355 (May 22, 2001)), because it is not a significant regulatory action under Executive Order 12866.

I. National Technology Transfer Advancement Act

Section 12(d) of the National Technology Transfer and Advancement Act of 1995 (NTTAA), Section 12(d) of Public Law 104–113, directs EPA to use voluntary consensus standards in its regulatory activities unless to do so would be inconsistent with applicable law or otherwise impractical. Voluntary consensus standards are technical standards (e.g., materials specifications, test methods, sampling procedures, and business practices) developed or adopted by voluntary consensus standards bodies. The NTTAA directs EPA to provide Congress, through OMB, explanations when the Agency decides not to use available and applicable voluntary consensus standards.

This final rule references technical standards. The technical standards are listed in § 86.1 of the regulatory text, and directions for how they may be obtained are provided in § 86.1.

J. Executive Order 12898: Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations

Executive Order (EO) 12898 (59 FR 7629 (Feb. 16, 1994)) establishes federal executive policy on environmental justice. Its main provision directs federal agencies, to the greatest extent practicable and permitted by law, to make environmental justice part of their mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations in the United States.

EPA has determined that this final rule will not have disproportionately high and adverse human health or environmental effects on minority or low-income populations because it increases the level of environmental protection for all affected populations without having any disproportionately high and adverse human health or environmental effects on any population, including any minority or low-income population. This action applies to all newly produced engines nationwide once implemented without regard for where those engines are ultimately used. EPA believes that all segments of society will benefit equally as a result of today's action and that no one will suffer adverse human health or environmental effects.

K. Congressional Review Act

The Congressional Review Act, 5 U.S.C. 801 *et seq.,* as added by the Small Business Regulatory Enforcement Fairness Act of 1996, generally provides that before a rule may take effect, the agency promulgating the rule must submit a rule report, which includes a copy of the rule, to each House of the Congress and to the Comptroller General of the United States. EPA will submit a report containing this rule and other required information to the U.S. Senate, the U.S. House of Representatives, and the Comptroller General of the United States prior to publication of the rule in the **Federal Register**. A Major rule cannot take effect until 60 days after it is published in the **Federal Register**. This action is not a ''major rule'' as defined by 5 U.S.C. 804(2). This rule will be effective April 27, 2009.

X. Statutory Provisions and Legal Authority

Statutory authority for today's final rule is found in the Clean Air Act, 42 U.S.C. 7401 *et seq.*, in particular, sections 202 and 206 of the Act, 42 U.S.C. 7521, 7525. This rule is being promulgated under the administrative and procedural provisions of Clean Air Act section 307(d), 42 U.S.C. 7607(d).

List of Subjects

40 CFR Part 86

Environmental protection, Administrative practice and procedure, Incorporation by reference, Motor vehicle pollution.

40 CFR Part 89

Environmental protection, Administrative practice and procedure, Confidential business information, Imports, Labeling, Motor vehicle pollution, Reporting and recordkeeping requirements, Research, Vessels, Warranty.

40 CFR Part 90

Environmental protection, Administrative practice and procedure, Confidential business information, Imports, Labeling, Reporting and recordkeeping requirements, Research, Warranty.

40 CFR Part 1027

Environmental protection, Administrative practice and procedure, Air pollution control, Imports, Reporting and recordkeeping requirements.

40 CFR Part 1033

Environmental protection, Administrative practice and procedure, Confidential business information, Incorporation by reference, Labeling, Penalties, Railroads, Reporting and recordkeeping requirements.

40 CFR Part 1042

Environmental protection, Administrative practice and procedure, Air pollution control, Confidential business information, Imports, Incorporation by reference, Labeling, Penalties, Vessels, Reporting and recordkeeping requirements, Warranties.

40 CFR Parts 1048, 1054, and 1060

Environmental protection, Administrative practice and procedure, Air pollution control, Confidential business information, Imports, Incorporation by reference, Labeling, Penalties, Reporting and recordkeeping requirements, Warranties.

40 CFR Part 1065

Environmental protection, Administrative practice and procedure, Incorporation by reference, Reporting and recordkeeping requirements, Research.

40 CFR Part 1068

Environmental protection, Administrative practice and procedure, Confidential business information, Imports, Incorporation by reference, Motor vehicle pollution, Penalties, Reporting and recordkeeping requirements, Warranties.

Dated: December 4, 2008.

Stephen L. Johnson,

Administrator.

■ For the reasons set out in the preamble, title 40 chapter I of the Code of Federal Regulations is amended as follows:

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

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

Authority: 42 U.S.C. 7401–7671q.

■ 2. Section 86.1 is revised to read as follows:

§ 86.1 Reference materials.

(a) The documents in paragraph (b) of this section have been incorporated by reference into this part with the approval of the Director of the Federal Register under 5 U.S.C. 552(a) and 1 CFR part 51. To enforce any edition other than that specified in this section, a notice of change must be published in the **Federal Register** and the material must be available to the public. All approved material is available for inspection at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202–741–6030 or go to *http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html*. Also, the material is available for inspection at the Air Docket, EPA/DC, EPA West, Room B102, 1301 Constitution Ave., NW., Washington, DC. The Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number for the Air Docket is 202–566–1742. Copies are also available from the sources listed below.

(b) The following paragraphs set forth the material that has been incorporated by reference in this part.

(1) *ASTM material*. Copies of these materials may be obtained from American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428–2959, or by calling 610–832–9585, or at *http://www.astm.org*.

(i) ASTM D 975–04c, Standard Specification for Diesel Fuel Oils, IBR approved for §§ 86.1910, 86.213–11.

(ii) ASTM D1945–91, Standard Test Method for Analysis of Natural Gas by Gas Chromatography, IBR approved for §§ 86.113–94, 86.513–94, 86.1213–94, 86.1313–94.

(iii) ASTM D2163–91, Standard Test Method for Analysis of Liquefied Petroleum (LP) Gases and Propane Concentrates by Gas Chromatography, IBR approved for §§ 86.113–94, 86.1213–94, 86.1313–94.

(iv) ASTM D2986–95a, Reapproved 1999, Standard Practice for Evaluation of Air Assay Media by the Monodisperse DOP (Dioctyl Phthalate) Smoke Test, IBR approved for §§ 86.1310–2007.

(v) ASTM D5186–91, Standard Test Method for Determination of Aromatic Content of Diesel Fuels by Supercritical Fluid Chromatography, IBR approved for §§ 86.113–07, 86.1313–91, 86.1313–94, 86.1313–98, 1313–2007.

(vi) ASTM E29–67, Reapproved 1980, Standard Recommended Practice for Indicating Which Places of Figures Are To Be Considered Significant in Specified Limiting Values, IBR approved for § 86.1105–87.

(vii) ASTM E29–90, Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications, IBR approved for §§ 86.609–84, 86.609–96, 86.609–97, 86.609–98, 86.1009–84, 86.1009–96, 86.1442, 86.1708–99, 86.1709–99, 86.1710–99, 86.1728–99.

(viii) ASTM E29–93a, Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications, IBR approved for §§ 86.098–15, 86.004–15, 86.007–11, 86.007–15, 86.1803–01, 86.1823–01, 86.1824–01, 86.1825–01, 86.1837–01.

(ix) ASTM F1471–93, Standard Test Method for Air Cleaning Performance of a High-Efficiency Particulate Air-Filter System, IBR approved § 86.1310–2007.

(2) *SAE material*. Copies of these materials may be obtained from Society of Automotive Engineers International, 400 Commonwealth Dr., Warrendale, PA 15096–0001, or by calling 724–776–4841, or at *http://www.sae.org*.

(i) SAE J1151, December 1991, Methane Measurement Using Gas Chromatography, 1994 SAE Handbook—SAE International Cooperative Engineering Program, Volume 1: Materials, Fuels, Emissions, and Noise; Section 13 and page 170

(13.170), IBR approved for §§ 86.111–94; 86.1311–94.

(ii) SAE J1349, June 1990, Engine Power Test Code—Spark Ignition and Compression Ignition, IBR approved for §§ 86.094–8, 86.096–8.

(iii) SAE J1850, July 1995, Class B Data Communication Network Interface, IBR approved for §§ 86.099–17, 86.1806–01.

(iv) SAE J1850, Revised May 2001, Class B Data Communication Network Interface, IBR approved for §§ 86.005–17, 86.007–17, 86.1806–04, 86.1806–05.

(v) SAE J1877, July 1994, Recommended Practice for Bar-Coded Vehicle Identification Number Label, IBR approved for §§ 86.095–35, 86.1806–01.

(vi) SAE J1892, October 1993, Recommended Practice for Bar-Coded Vehicle Emission Configuration Label, IBR approved for §§ 86.095–35, 86.1806–01.

(vii) SAE J1930, Revised May 1998, Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms, IBR approved for §§ 86.096–38, 86.004–38, 86.007–38, 86.010–38, 86.1808–01, 86.1808–07.

(viii) SAE J1930, Revised April 2002, Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms—Equivalent to ISO/TR 15031–2: April 30, 2002, IBR approved for §§ 86.005–17, 86.007–17, 86.010–18, 86.1806–04, 86.1806–05.

(ix) SAE J1937, November 1989, Engine Testing with Low Temperature Charge Air Cooler Systems in a Dynamometer Test Cell, IBR approved for §§ 86.1330–84, 86.1330–90.

(x) SAE J1939, Revised October 2007, Recommended Practice for a Serial Control and Communications Vehicle Network, IBR approved for §§ 86.010–18.

(xi) SAE J1939–11, December 1994, Physical Layer—250K bits/s, Shielded Twisted Pair, IBR approved for §§ 86.005–17, 86.1806–05.

(xii) SAE J1939–11, Revised October 1999, Physical Layer—250K bits/s, Shielded Twisted Pair, IBR approved for §§ 86.005–17, 86.007–17, 86.1806–04, 86.1806–05.

(xiii) SAE J1939–13, July 1999, Off-Board Diagnostic Connector, IBR approved for §§ 86.005–17, 86.007–17, 86.1806–04, 86.1806–05.

(xiv) SAE J1939–13, Revised March 2004, Off-Board Diagnostic Connector, IBR approved for § 86.010–18.

(xv) SAE J1939–21, July 1994, Data Link Layer, IBR approved for §§ 86.005–17, 86.1806–05.

(xvi) SAE J1939–21, Revised April 2001, Data Link Layer, IBR approved for §§ 86.005–17, 86.007–17, 86.1806–04, 86.1806–05.

(xvii) SAE J1939–31, Revised December 1997, Network Layer, IBR approved for §§ 86.005–17, 86.007–17, 86.1806–04, 86.1806–05.

(xviii) SAE J1939–71, May 1996, Vehicle Application Layer, IBR approved for §§ 86.005–17, 86.1806–05.

(xix) SAE J1939–71, Revised August 2002, Vehicle Application Layer—J1939–71 (through 1999), IBR approved for §§ 86.005–17, 86.007–17, 86.1806–04, 86.1806–05.

(xx) SAE J1939–71, Revised January 2008, Vehicle Application Layer (Through February 2007), IBR approved for § 86.010–38.

(xxi) SAE J1939–73, February 1996, Application Layer—Diagnostics, IBR approved for §§ 86.005–17, 86.1806–05.

(xxii) SAE J1939–73, Revised June 2001, Application Layer—Diagnostics, IBR approved for §§ 86.005–17, 86.007–17, 86.1806–04, 86.1806–05.

(xxiii) SAE J1939–73, Revised September 2006, Application Layer—Diagnostics, IBR approved for §§ 86.010–18, 86.010–38.

(xxiv) SAE J1939–81, July 1997, Recommended Practice for Serial Control and Communications Vehicle Network Part 81—Network Management, IBR approved for §§ 86.005–17, 86.007–17, 86.1806–04, 86.1806–05.

(xxv) SAE J1939–81, Revised May 2003, Network Management, IBR approved for § 86.010–38.

(xxvi) SAE J1962, January 1995, Diagnostic Connector, IBR approved for §§ 86.099–17, 86.1806–01.

(xxvii) SAE J1962, Revised April 2002, Diagnostic Connector Equivalent to ISO/DIS 15031–3; December 14, 2001, IBR approved for §§ 86.005–17, 86.007–17, 86.010–18, 86.1806–04, 86.1806–05.

(xxviii) SAE J1978, Revised April 2002, OBD II Scan Tool—Equivalent to ISO/DIS 15031–4; December 14, 2001, IBR approved for §§ 86.005–17, 86.007–17, 86.010–18, 86.1806–04, 86.1806–05.

(xxix) SAE J1979, July 1996, E/E Diagnostic Test Modes, IBR approved for §§ 86.099–17, 86.1806–01.

(xxx) SAE J1979, Revised September 1997, E/E Diagnostic Test Modes, IBR approved for §§ 86.096–38, 86.004–38, 86.007–38, 86.010–38, 86.1808–01, 86.1808–07.

(xxxi) SAE J1979, Revised April 2002, E/E Diagnostic Test Modes—Equivalent to ISO/DIS 15031–5; April 30, 2002, IBR approved for §§ 86.099–17, 86.005–17, 86.007–17, 86.1806–01, 86.1806–04, 86.1806–05.

(xxxii) SAE J1979, Revised May 2007, (R) E/E Diagnostic Test Modes, IBR approved for § 86.010–18, 86.010–38.

(xxxiii) SAE J2012, July 1996, Recommended Practice for Diagnostic Trouble Code Definitions, IBR approved for §§ 86.099–17, 86.1806–01.

(xxxiv) SAE J2012, Revised April 2002, (R) Diagnostic Trouble Code Definitions Equivalent to ISO/DIS 15031–6: April 30, 2002, IBR approved for §§ 86.005–17, 86.007–17, 86.010–18, 86.1806–04, 86.1806–05.

(xxxv) SAE J2284–3, May 2001, High Speed CAN (HSC) for Vehicle Applications at 500 KBPS, IBR approved for §§ 86.096–38, 86.004–38, 86.007–38, 86.010–38, 86.1808–01, 86.1808–07.

(xxxvi) SAE J2403, Revised August 2007, Medium/Heavy-Duty E/E Systems Diagnosis Nomenclature—Truck and Bus, IBR approved for §§ 86.007–17, 86.010–18, 86.010–38, 86.1806–05.

(xxxvii) SAE J2534, February 2002, Recommended Practice for Pass-Thru Vehicle Programming, IBR approved for §§ 86.096–38, 86.004–38, 86.007–38, 86.010–38, 86.1808–01, 86.1808–07.

(xxxviii) SAE J2534–1, Revised December 2004, (R) Recommended Practice for Pass-Thru Vehicle Programming, IBR approved for § 86.010–38.

(3) *ANSI material*. Copies of these materials may be obtained from the American National Standards Institute, 25 W 43rd Street, 4th Floor, New York, NY 10036, or by calling 212–642–4900, or at *http://www.ansi.org*.

(i) ANSI/AGA NGV1–1994, Standard for Compressed Natural Gas Vehicle (NGV) Fueling Connection Devices, IBR approved for §§ 86.001–9, 86.004–9, 86.098–8, 86.099–8, 86.099–9, 86.1810–01.

(ii) [Reserved]

(4) *California regulatory requirements.* Copies of these materials may be obtained from U.S. EPA, see paragraph (a) of this section, or from the California Air Resources Board by calling 916–322–2884, or at *http://www.arb.ca.gov*.

(i) California Regulatory Requirements Applicable to the ''LEV II'' Program, including:

(A) California Exhaust Emission Standards and Test Procedures for 2003 and Subsequent Model Zero-Emission Vehicles and 2001 and Subsequent Model Hybrid Electric Vehicles, in the Passenger Car, Light-duty Truck and Medium-duty Vehicle Classes, August 5, 1999, IBR approved for §§ 86.1806–01, 86.1811–04, 86.1844–01.

(B) California Non-Methane Organic Gas Test Procedures, August 5, 1999, IBR approved for §§ 86.1803–01, 86.1810–01, 86.1811–04.

(ii) California Regulatory Requirements Applicable to the National Low Emission Vehicle

Program, October 1996, IBR approved for §§ 86.113–04, 86.612–97, 86.1012–97, 86.1702–99, 86.1708–99, 86.1709–99, 86.1717–99, 86.1735–99, 86.1771–99, 86.1775–99, 86.1776–99, 86.1777–99, Appendix XVI, Appendix XVII.

(iii) California Regulatory Requirements known as On-board Diagnostics II (OBD–II), Approved on April 21, 2003, Title 13, California Code Regulations, Section 1968.2, Malfunction and Diagnostic System Requirements for 2004 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines (OBD–II), IBR approved for § 86.1806–05.

(iv) California Regulatory Requirements known as On-board Diagnostics II (OBD–II), Approved on November 9, 2007, Title 13, California Code Regulations, Section 1968.2, Malfunction and Diagnostic System Requirements for 2004 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines (OBD–II), IBR approved for §§ 86.007–17, 86.1806–05.

(5) *ISO material*. Copies of these materials may be obtained from the International Organization for Standardization, Case Postale 56, CH–1211 Geneva 20, Switzerland, or by calling 41–22–749–01–11, or at *http://www.iso.org*.

(i) ISO 9141–2, February 1, 1994, Road vehicles—Diagnostic systems—Part 2: CARB requirements for interchange of digital information, IBR approved for §§ 86.099–17, 86.005–17, 86.007–17, 86.1806–01, 86.1806–04, 86.1806–05.

(ii) ISO 14230–4:2000(E), June 1, 2000, Road vehicles—Diagnostic systems—KWP 2000 requirements for Emission-related systems, IBR approved for §§ 86.099–17, 86.005–17, 86.007–17, 86.1806–01, 86.1806–04, 86.1806–05.

(iii) ISO 15765–4.3:2001, December 14, 2001, Road Vehicles—Diagnostics on Controller Area Networks (CAN)—Part 4: Requirements for emissions-related systems, IBR approved for §§ 86.005–17, 86.007–17, 86.1806–04, 86.1806–05.

(iv) ISO 15765–4:2005(E), January 15, 2005, Road Vehicles—Diagnostics on Controller Area Networks (CAN)—Part 4: Requirements for emissions-related systems, IBR approved for §§ 86.007–17, 86.010–18, 86.1806–05.

(6) *NIST material*. NIST publications are sold by the Government Printing Office (GPO) and by the National Technical Information Service (NTIS). To purchase a NIST publication you must have the order number. Order numbers are available from the NIST Public Inquiries Unit at (301) 975–NIST. Mailing address: NIST Public Inquiries, NIST, 100 Bureau Drive, Stop 3460, Gaithersburg, Md., 20899–3460. If you have a GPO stock number, you can purchase printed copies of NIST publications from GPO. Orders should be sent to the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402–9325. For more information, or to place an order, call (202) 512–1800, fax: (202) 512–2250. More information can also be found at *http://www.nist.gov*.

(i) NIST Special Publication 811, 1995 Edition, Guide for the Use of the International System of Units (SI), IBR approved for § 86.1901.

(ii) [Reserved]

(7) *Truck and Maintenance Council material*. Copies of these materials may be obtained from the Truck and Maintenance Council, 950 North Glebe Road, Suite 210, Arlington, VA 22203–4181, or by calling 703–838–1754.

(i) TMC RP 1210B, Revised June 2007, WINDOWS™ COMMUNICATION API, IBR approved for § 86.010–38.

(ii) [Reserved]

■ 3. Section 86.007–17 is added to Subpart A to read as follows:

§ 86.007–17 On-board Diagnostics for engines used in applications less than or equal to 14,000 pounds GVWR.

(a) *General*.

(1) 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.

(2) An OBD system demonstrated to fully meet the requirements in § 86.1806–05 may be used to meet the requirements of this section, provided that the Administrator finds that a manufacturer's decision to use the flexibility in this paragraph (a)(2) is based on good engineering judgment.

(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 ''Supplemental emission test; test cycle and procedures'' contained in § 86.1360, and 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 filters*.

(i) *Otto-cycle*. Catalyst deterioration or malfunction before it results in an increase in NMHC (or NO_X+NMHC, as applicable) emissions 1.5 times the NMHC (or NO_X+NMHC, as applicable) standard or family emission limit (FEL), as compared to the NMHC (or NO_X+NMHC, as applicable) emission level measured using a representative 4000 mile catalyst system.

(ii) *Diesel*.

(A) If equipped, reduction catalyst deterioration or malfunction before it results in exhaust NO_X emissions exceeding, for model years 2007 through 2012, either 1.75 times the applicable NO_X standard for engines certified to a NO_X family emission limit (FEL) greater than 0.50 g/bhp-hr, or the applicable NO_X FEL+0.6 g/bhp-hr for engines certified to a NO_X FEL less than or equal to 0.50 g/bhp-hr and, for model years 2013 and later, the applicable NO_X FEL+0.3 g/bhp-hr. If equipped, diesel oxidation catalyst (DOC) deterioration or malfunction before it results in exhaust NMHC emissions exceeding, for model years 2010 through 2012, 2.5 times the applicable NMHC standard and, for model years 2013 and later, 2 times the applicable NMHC standard. These catalyst monitoring requirements need not be done if the manufacturer can demonstrate that deterioration or malfunction of the system will not result in exceedance of the threshold. As an alternative, oxidation catalyst deterioration or malfunction before it results in an inability to achieve a temperature rise of 100 degrees C, or to reach the necessary diesel particulate filter (DPF) regeneration temperature, within 60 seconds of initiating an active DPF regeneration. Further, oxidation catalyst deterioration or malfunction when the DOC is unable to sustain the necessary regeneration temperature for the duration of the regeneration event. The OBD or control system must abort the regeneration if the regeneration temperature has not been reached within five minutes of initiating an active regeneration event, and if the regeneration temperature cannot be sustained for the duration of the regeneration event.

(B) If equipped with a DPF for model years 2007 through 2009, catastrophic failure of the device must be detected. Any DFP whose complete failure results in exhaust emissions exceeding 1.5 times the applicable standard or FEL for NMHC (or NO_X+NMHC, as applicable) or PM must be monitored for such catastrophic failure. This monitoring need not be done if the manufacturer can demonstrate that a catastrophic failure of the system will not result in exceedance of the threshold. If equipped with a DPF for model years 2010 and later, DPF deterioration or malfunction before it results in exhaust emissions exceeding the applicable PM FEL+0.04 g/bhp-hr or 0.05 g/bhp-hr PM, whichever is higher. As an alternative to this requirement for 2010 through 2012, the OBD system can be designed to detect a malfunction based on a detectable decrease in the expected pressure drop across the DPF for a period of 5 seconds or more, whenever the engine is speed is greater than or equal to 50% (as defined in § 1065.610, Eq. 1065.610–3) and engine load, or torque, is greater than or equal to 50% of the maximum available at that speed under standard emission test conditions. For purposes of this paragraph, the detectable change in pressure drop is defined by operating the engine at its 50% speed and 50% load point under standard emission test conditions, observing the pressure drop on a clean DPF, and multiplying the observed pressure drop by 0.5. The detectable change in pressure drop shall be reported in units of kilopascals (kPa). At time of certification, manufacturers shall provide the detectable change in pressure drop value along with OBD engine data parameters recorded at the following nine engine speed/load operating points with a clean DPF: 50% speed, 50% load; 50% speed, 75% load, 50% speed, 100% load; 75% speed, 50% load; 75% speed, 75% load; 75% speed, 100% load; 100% speed, 50% load; 100% speed, 75% load; and 100% speed, 100% load. The OBD engine data pararmeters to be reported are described in § 86.010–18(k)(4)(ii) and shall include the following: engine speed; calculated load; air flow rate from mass air flow sensor (if so equipped); fuel rate; and DPF delta pressure. On all engines so equipped, catastrophic failure of the particulate trap must also be detected. In addition, the absence of the particulate trap or the trapping substrate must be detected.

(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 NO_X+NMHC, as applicable) or CO; and any misfire capable of damaging the catalytic converter.

(ii) *Diesel.* Lack of cylinder combustion must be detected.

(3) *Exhaust gas sensors.*

(i) *Oxygen sensors and air-fuel ratio sensors downstream of aftertreatment devices.*

(A) *Otto-cycle.* If equipped, sensor deterioration or malfunction resulting in exhaust emissions exceeding 1.5 times the applicable standard or FEL for NMHC, NO_X or CO.

(B) *Diesel.* If equipped, sensor deterioration or malfunction resulting in exhaust emissions exceeding any of the following levels: The applicable PM FEL+0.04 g/bhp-hr or 0.05 g/bhp-hr PM, whichever is higher; or, for model years 2007 through 2012, 1.75 times the applicable NO_X standard for engines certified to a NO_X FEL greater than 0.50 g/bhp-hr, or, the applicable NO_X FEL+0.6 g/bhp-hr for engines certified to a NO_X FEL less than or equal to 0.50 g/bhp-hr and, for model years 2013 and later, the applicable NO_X FEL+0.3 g/bhp-hr; or, for model years 2010 through 2012, 2.5 times the applicable NMHC standard and, for model years 2013 and later, 2 times the applicable NMHC standard.

(ii) *Oxygen sensors and air-fuel ratio sensors upstream of aftertreatment devices.*

(A) *Otto-cycle.* If equipped, sensor deterioration or malfunction resulting in exhaust emissions exceeding 1.5 times the applicable standard or FEL for NMHC, NO_X or CO.

(B) *Diesel.* If equipped, sensor deterioration or malfunction resulting in exhaust emissions exceeding any of the following levels: for model years 2007 through 2009, the applicable PM FEL+0.04 g/bhp-hr or 0.05 g/bhp-hr PM, whichever is higher and, for model years 2010 and later, the applicable PM FEL+0.02 g/bhp-hr or 0.03 g/bhp-hr PM, whichever is higher; or, for model years 2007 through 2012, 1.75 times the applicable NO_X standard for engines certified to a NO_X FEL greater than 0.50 g/bhp-hr, or the applicable NO_X FEL+0.6 g/bhp-hr for engines certified to a NO_X FEL less than or equal to 0.50 g/bhp-hr and, for model years 2013 and later, the applicable NO_X FEL+0.3 g/bhp-hr ; or, for model years 2007 through 2012, 2.5 times the applicable NMHC standard and, for model years 2013 and later, 2 times the applicable NMHC standard; or, for 2007 through 2012, 2.5 times the applicable CO standard and, for model years 2013 and later, 2 times the applicable CO standard.

(iii) *NO_X sensors.*

(A) *Otto-cycle.* If equipped, sensor deterioration or malfunction resulting in exhaust emissions exceeding 1.5 times the applicable standard or FEL for NMHC, NO_X or CO.

(B) *Diesel.* If equipped, sensor deterioration or malfunction resulting in exhaust emissions exceeding any of the following levels: the applicable PM FEL+0.04 g/bhp-hr or 0.05 g/bhp-hr PM, whichever is higher; or, for model years 2007 through 2012, 1.75 times the applicable NO_X standard for engines certified to a NO_X FEL greater than 0.50 g/bhp-hr; or, the applicable NO_X FEL+0.6 g/bhp-hr for engines certified to a NO_X FEL less than or equal to 0.50 g/bhp-hr and, for model years 2013 and later, the applicable NO_X FEL+0.3 g/bhp-hr.

(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 and components.*

(i) *Otto-cycle.* 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 or CO. 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.

(ii) *Diesel.* 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, and the fuel control system, singularly resulting in exhaust emissions exceeding any of the following levels: for model years 2007 through 2009, the applicable PM FEL+0.04 g/bhp-hr or 0.05 g/bhp-hr PM, whichever is higher and, for model years 2010 and later, the applicable PM FEL+0.02 g/bhp-hr or 0.03 g/bhp-hr PM, whichever is higher; or, for model years 2007 through 2012, 1.75 times the applicable NO_X standard for engines certified to a NO_X FEL greater than 0.50 g/bhp-hr or the applicable NO_X FEL+0.6 g/bhp-hr for engines certified to a NO_X FEL less than or equal to 0.50 g/bhp-hr and, for model years 2013 and later, the applicable NO_X FEL+0.3 g/bhp-hr; or, for model years 2007 through 2012, 2.5 times the applicable NMHC standard and, for model years 2013 and later, 2 times the applicable NMHC standard; or, for model years 2007 through 2012, 2.5 times the applicable CO standard and, for model years 2013 and later, 2 times the applicable CO standard. 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 a malfunction would not cause emissions to exceed the applicable levels. This demonstration is subject to Administrator approval. For engines equipped with crankcase ventilation (CV), monitoring of the CV system is not necessary provided the manufacturer can demonstrate to the Administrator's satisfaction that the CV 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.* Any sensor or 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 engines 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.*

(1) 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.

(2) *Drive cycle or driving cycle,* in the context of this § 86.007–17 and for model years 2010 and later, a drive cycle means operation that consists of engine startup and engine shutoff and includes the period of engine off time up to the next engine startup. For vehicles that employ engine shutoff strategies (e.g., engine shutoff at idle), the manufacturer may use an alternative definition for drive cycle (e.g., key-on followed by key-off). Any alternative definition must be based on equivalence to engine startup and engine shutoff signaling the beginning and ending of a single driving event for a conventional vehicle. For applications that span 14,000 pounds GVWR, the manufacturer may use the drive cycle definition of § 86.010–18 in lieu of the definition in this paragraph.

(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'').